


# SIXTIETH ANNUAL REPORT

TO THE

# International Joint Commission

COVERING

## Calendar Year 2018

## International Souris River Board

INTERNATIONAL SOURIS
RIVER BOARD

CONSEIL INTERNATIONALE
DE LA RIVIERE SOURIS

October 2019

The International Joint Commission
Ottawa, Ontario and Washington, D.C.

Commissioners:

In accordance with the Directive of January 22, 2007 (replaces Directives of April 11, 2002 and May 31, 1959), we have enclosed the Sixtieth Annual Report covering calendar year 2018.

Respectively submitted,

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# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## LIST OF APPENDICES

# 1.0 SUMMARY

## 1.1 2018 APPORTIONMENT

For the 2018 calendar year, the natural flow of the Souris River at the Sherwood Crossing was 55,422 cubic decametres (44,931 acre-feet), which represents 35 percent of the 1959-2018 long-term mean. North Dakota received 32,731 cubic decametres (26,535 acre-feet) or 59 percent of the natural flow.

Net depletions in Canada were 20,058 cubic decametres (16,261 acre-feet). Recorded runoff for the Souris River near Sherwood, North Dakota, was 32,731 cubic decametres (26,535 acre-feet), or about 24 percent of the 1931-2018 long-term mean.

The apportionment between Canada and the United States was discussed at the February 21, 2018 meeting of the International Souris River Board (Board). The Board reviewed the spring 2018 runoff forecast hydrologic conditions and declared 2018 to be a non-flood year.

*Based on the projected runoff volumes, the apportionment split was determined to be 50/50 according to Annex B of the 1989 International Agreement.*

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 5,006 cubic decametres (4,058 acre-feet), or 16 percent of the long-term mean since 1959. Recommendation No. 2 of the Interim Measures was met with a net gain in the North Dakota portion of the Long Creek basin of 1,946 cubic decametres (1,578 acre-feet).

Recorded runoff leaving the United States at Westhope, during the period of June 1 through October 31, was 37,583 cubic decametres (30,469 acre-feet). The flow was not in compliance with the 0.566 cms (20 cfs) minimum flow requirement for the June 1 to October 31 period as specified in Recommendation No. 3(a) of the Interim Measures. The period of noncompliance was August 25 to 26, September 2, and September 4 to 5.

## 1.2 2018 WATER QUALITY OBJECTIVES

The water quality of the Souris River in calendar year 2018 has had median values approximately the same or less than the median values over the past four years for most of the parameters.

When compared to the historical median, most of the median values in 2018 are similar.

Dissolved oxygen concentrations, of great concern in the past, were at or above the water quality objective of 5.0 milligrams per litre at both boundary stations, except for two low values at Westhope in January and February under cover of ice.

At the Sherwood site, sulfate concentrations have increased over the last six years. Median phosphorus concentrations are higher than historic values but have remained fairly constant over the last ten years. Concentrations of boron have remained constant since 2010. Iron concentrations have returned to near the historic median values after a period of very high values from 2011 to 2014. Chloride concentrations have decreased over the last ten years.

Exceedances of water quality objectives that occurred at both sites were for parameters that historically have had exceedances of the water quality objectives, except for an unusual boron exceedance at Westhope.

Exceedances of specific water quality objectives at the Saskatchewan/North Dakota boundary include E. coli, phosphorus, sodium, sulfate, pH, total dissolved solids, total suspended solids, and iron.

Exceedances at the North Dakota/Manitoba boundary include phosphorus, sodium, sulfate, chloride, dissolved oxygen, pH, total suspended solids, total dissolved solids, boron, and iron.

The Board's Aquatic Ecosystem Health Committee is considering a review of water quality objectives that would provide further perspective on the exceedances observed at the boundaries.

## 2.0 INTRODUCTION

The 2018 annual report documents the activities of the International Souris River Board (Board). The report also contains a brief history of the Board, which details the Board's membership, duties, and committees. The report summarizes hydrologic and water quality conditions, and water use for the basin related to the Board's mandate.

The Board ensures compliance with sharing of the Souris basin transboundary water, oversight of flood operations, an ecosystem approach to transboundary water issues, and assists the International Joint Commission (IJC) in preventing and resolving transboundary disputes.

## 3.0 INTERNATIONAL SOURIS RIVER BOARD

### 3.1 SOURIS RIVER REFERENCE (1940)

In a letter on behalf of the Government of Canada dated 20 March 1959 and a letter on behalf of the Government of the United States of America dated 3 April 1959, the IJC was informed that the Interim Measures recommended in its report of 19 March 1958, in substitution for those recommended in the report dated 2 October 1940 in response to the Souris River Reference (1940), had been accepted by both Governments.

The Governments of the United States and Canada entered into an Agreement for Water Supply and Flood Control in the Souris River Basin on October 26, 1989. Pursuant to this Agreement, the Interim Measures related to the sharing of the annual flow of the Souris River from Saskatchewan into North Dakota contained in paragraph 22(1) of the IJC's 1958 Report to the Governments were modified. In light of the modifications in 1989 and pursuant to a February 28, 1992, request from the Governments of the United States and Canada, the IJC, on April 23, 1992, directed the International Souris River Board of Control to begin applying the "Interim Measures as Modified in 1992." The measures were further modified by the Governments in December 2000. The "Interim Measures as Modified in 2000" are shown in Appendix C of this report.

### 3.2 INTERIM MEASURES AS MODIFIED IN 2000

In December 2000, the IJC directed the Board to implement the "Interim Measures as Modified in 2000" for the 2001 calendar year and each year thereafter. The 2000 Interim Measures, shown in Appendix C, were developed to provide greater clarification of the conditions that must prevail for the determination of the sharing of natural flow between Saskatchewan and North Dakota at the Sherwood Crossing.

In general, the Interim Measures provide that Saskatchewan shall have the right to divert, store, and use waters that originate in the Saskatchewan portion of the Souris River Basin, provided that the annual runoff of the river into North Dakota is not thereby reduced to less than half of the runoff that would have occurred in a state of nature; that North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the basin together with the waters that cross the boundary from Saskatchewan; and that Manitoba shall have the right to use the waters that originate in the Manitoba portion of the basin and, in addition, that North Dakota must provide to Manitoba, except during periods of severe drought, a regulated flow of at least 0.566 cms (20 cfs) during the months of June through October.

For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall as far as practicable regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cms (4 cfs) when that level of flow would have occurred under the conditions of water-use development prevailing in the Saskatchewan portion of the drainage basin prior to the construction of Boundary Dam, Rafferty Dam, and Grant Devine Dam.

Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Grant Devine Reservoirs. During years when those conditions occur, the minimum flow actually passed to North Dakota will be 40 percent of the natural flow at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Grant Devine Dam for flood control.

Except in flood years, flow releases to the United States should occur in the pattern that would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time.

The State of North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the Souris River Basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing, provided that any diversion, use, or storage of Long Creek water shall not diminish the annual runoff at the Eastern Crossing of Long Creek into Saskatchewan below the annual runoff of Long Creek at the Western Crossing into North Dakota.

In periods of severe drought, when it becomes impracticable for North Dakota to deliver the regulated flow of 0.566 cms (20 cfs), North Dakota's responsibility to Manitoba will be limited to providing such flows as the Board determines to be practicable and in accordance with the objective of making water available for human and livestock consumption as well as for household use.

## 3.3 BOARD OF CONTROL

In May 1959, the IJC officially approved and signed a directive that created the International Souris River Board of Control. The directive charged the Board with the responsibility of ensuring compliance with the Interim Measures as set out in 1958 and of submitting such reports as the IJC may require or as the Board, at its discretion, may desire to file.

## 3.4 AMALGAMATION OF THE INTERNATIONAL SOURIS-RED RIVERS ENGINEERING BOARD AND INTERNATIONAL SOURIS RIVER BOARD OF CONTROL

In 2000, the IJC directed the International Souris-Red Rivers Engineering Board to transfer its responsibilities that related to the Souris River to the International Souris River Board of Control. The IJC also changed the International Souris River Board of Control's name to the International Souris River Board.

## 3.5 AMALGAMATION OF THE INTERNATIONAL SOURIS RIVER BOARD AND SOURIS RIVER BI-LATERAL WATER QUALITY MONITORING GROUP

By letter dated January 22, 2007, the Board was officially notified by the IJC that the new directive dated January 18, 2007, replaced the previous directive dated April 11, 2002. The new directive sets out the duties of the Board as it moves toward a watershed approach in the Souris

River Basin and combined the duties of the Board and Souris River Bi-Lateral Water Quality Monitoring Group. It also increased the membership of the Board to twelve members.

The Board's duties were revised to include the following:

- Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River Basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the IJC about existing or potential transboundary issues.
- Oversee the implementation of compliance with the Interim Measures as Modified for Apportionment of the Souris River as described in Appendix A of the Directive.
- Assist the IJC in the review of a Joint Water Quality Monitoring Program.
- Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.
- Report on aquatic ecosystem health issues in the watershed and regularly inform the IJC on the state and implications of aquatic ecosystem health.
- Carry out such other studies or activities as the IJC may, from time to time, request.
- Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year.
- The Board shall submit an annual report covering all of its activities at least three weeks in advance of the IJC's fall semi-annual meeting, and the Board shall submit other reports as the IJC may request or the Board may feel appropriate in keeping with this Directive.
- The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year. The Board has agreed to hold the public meeting in the spring/summer and to advertise it.

In 2007 three committees were established to assist the Board in administering the requirements of its enhanced mandate. The Natural Flow Methods Committee was renamed as the Hydrology Committee and is charged with investigating procedures and questions on the approach and methods used to determine the natural flow of the Souris River Basin. The Flow Forecasting Liaison Committee (FFLC) has the responsibility to ensure information sharing and coordination between the forecasting agencies in the basin. The Aquatic Ecosystem Health Committee (AEHC) has the responsibility to identify water quality and aquatic health concerns in the basin and to report on the adequacy of the aquatic quality monitoring programs. Membership on these committees includes all affected agencies in the basin. In 2018 the Board established the Communications and Outreach Committee to undertake improved communications and outreach activities specific to the needs of the Board.

## 3.6 BOARD MEMBERS

At the end of 2018, the members of the Board were as follows:

**Nicole Armstrong** — Member for Canada
Manitoba Sustainable Development (Co-Chair)
Winnipeg, Manitoba

**Russell Boals** — Member for Canada
Retired
Regina, Saskatchewan

**John Fahlman** — Member for Canada
Saskatchewan Water Security Agency
Moose Jaw, Saskatchewan

**Mark Lee** — Member for Canada
Manitoba Sustainable Development
Regina, Saskatchewan

**John-Mark Davies** — Member for Canada
Saskatchewan Water Security Agency
Saskatoon, Saskatchewan

**Jeff Woodward** — Member for Canada
Environment and Climate Change Canada
Regina, Saskatchewan

**David Pattyson** — Member for Canada
Agri-Environmental Group Plans
Tribune, Saskatchewan

**Debbie McMechan** — Member for Canada
Reeve of Two Borders
Two Borders, Manitoba

**Joe Goodwill** — Member for Canada
Deputy-Mayor of Souris
Souris, Manitoba

**Garland Erbele** — Member for the United States
North Dakota State Engineer (Co-Chair)
Bismarck, North Dakota

**Frank Durbian** — Member for the United States
U.S. Fish and Wildlife Service

Towner, North Dakota

**Colonel Samuel Calkins** — Member for the United States
U.S. Army Corps of Engineers
St. Paul, Minnesota

**Gregg Wiche** — Member for the United States
Retired
Bismarck, North Dakota

**Scott Gangl** — Member for the United States
North Dakota Game and Fish Department
Bismarck, North Dakota

**Dave Glatt** — Member for the United States
North Dakota Department of Health
Bismarck, North Dakota

**Shelly Weppler** — Member for the United States
Ward County Commissioner
Minot, North Dakota

**Lorinda Haman** — Member for the United States
North McHenry Soil Conservation District
Towner, North Dakota

**David O'Connell** — Member for the United States
Retired
Lansford, North Dakota

**Secretaries**

**Girma Sahlu** — Canada
Environment and Climate Change Canada
Winnipeg, Manitoba

**Darin Schepp** — United States
North Dakota State Water Commission
Bismarck, North Dakota

## 4.0 2018 ACTIVITIES OF THE BOARD

Since the presentation of the Fifty-Ninth Annual Report to the IJC, the Board has held two face to face meetings and one public meeting. The discussions and decisions made are summarized in the following sections.

## 4.1 2018 SPRING MEETING

The Board held its annual spring meeting in Minot, North Dakota on February 21, 2018.

The agenda for the Board's meeting included the following topics:

- Review of 2017 Hydrologic Conditions, Spring 2018 Hydrologic Forecast and Planned Operations.
- Compliance of Souris River Flows to December 31, 2017
- Update from the Hydrology Committee
- Water Quantity Monitoring
- Water Appropriations in the Souris River Basin during 2017
- Update from the Flow Forecasting Liaison Committee (FFLC)
- Update from the Aquatic Ecosystem Health Committee (AEHC)
- Compliance with Water Quality Objectives for 2017
- Water Quality Monitoring Plan
- ISRB Communications
- International Souris River Study Board (ISRSB) Update
- Update on Water Management Projects
- International Watershed Initiative Projects
- 2017 Souris River Basin Flood Report

Details of the 2018 spring meeting are provided under Appendix G.

## 4.2 2018 SUMMER MEETING

The Board held its annual summer meeting in Estevan, Saskatchewan on June 26, 2018. The Board also hosted a public meeting on the evening of June 25, 2018 (in partnership with the International Souris River Study Board) and a tour of sites in the Saskatchewan portion of the basin on June 27, 2018.

The agenda for the Board's meeting included the following topics:

- Determination of Natural Flow of the Souris River at Sherwood to May 31, 2018
- Update from the Hydrology Committee
- Review of 2018 Hydrologic Conditions, Operations, and Hydrologic Forecasts
- Flow Forecasting Liaison Committee (FFLC) Update
- Aquatic Ecosystem Health Committee (AEHC) Update
- Compliance with Water Quality Objectives for 2017
- International Watershed Initiative Projects
- International Souris River Study Board Update

- Update on Water Management Projects
- ISRB Communication
- International Souris River Board Work Plan

Details of the 2018 summer meeting are provided under Appendix G.

## 5.0 MONITORING

## 5.1 INSPECTIONS OF THE BASIN

During 2018, the staff of the Water Survey Division of ECCC, WSA, NDSWC, MSD, and USGS carried out frequent field inspections of the Souris River Basin.

## 5.2 GAUGING STATIONS

A list of the gauging stations operated in the Souris River basin is provided in Table 1. In addition, the USGS operated three miscellaneous streamflow measurement sites in the vicinity of the Eaton Irrigation Project near Towner, North Dakota. The station numbers and locations of the stations measuring streamflow, water level, and water quality are shown below in Tables 1, 2, and 3, respectively.

**Table 1.** Streamflow stations in the Souris River Basin

| Index Number | Stream | Location | State or Province | Operated by |
|---|---|---|---|---|
| 05NA003 (5113360) | Long Creek[1] | at Western Crossing | Saskatchewan | Environment and Climate Change Canada |
| 05NA004 | Long Creek | near Maxim | Saskatchewan | Saskatchewan Water Security Agency |
| 05NA005 | Gibson Creek | near Radville | Saskatchewan | Environment and Climate Change Canada |
| 05NB001 | Long Creek | near Estevan | Saskatchewan | Environment and Climate Change Canada |
| 05NB011 | Yellow Grass Ditch | near Yellow Grass | Saskatchewan | Environment and Climate Change Canada |
| 05NB014 | Jewel Creek | near Goodwater | Saskatchewan | Environment and Climate Change Canada |
| 05NB018 | Tatagwa Lake Drain | near Weyburn | Saskatchewan | Environment and Climate Change Canada |
| 05NB021 (5113800) | Short Creek[1] | near Roche Percee | Saskatchewan | Environment and Climate Change Canada |
| 05NB031 | Souris River | near Bechard[2] | Saskatchewan | Saskatchewan Water Security Agency |
| 05NB033 | Moseley Creek | near Halbrite | Saskatchewan | Environment and Climate Change Canada |
| 05NB034 | Roughbark Creek | near Goodwater | Saskatchewan | Environment and Climate Change Canada |
| 05NB035 | Cooke Creek | near Goodwater | Saskatchewan | Environment and Climate Change Canada |
| 05NB036 | Souris River | below Rafferty Reservoir | Saskatchewan | Environment and Climate Change Canada |
| 05NB038 | Boundary Reservoir Diversion Canal | near Estevan | Saskatchewan | Environment and Climate Change Canada |
| 05NB039 | Tributary | near Outram | Saskatchewan | Environment and Climate Change Canada |
| 05NB040 | Souris River | near Ralph | Saskatchewan | Environment and Climate Change Canada |
| 05NB041 | Roughbark Creek | above Rafferty Reservoir | Saskatchewan | Environment and Climate Change Canada |
| 05NC001 | Moose Mountain Creek | below Moose Mountain Lake | Saskatchewan | Saskatchewan Water Security Agency |
| 05ND010 | Moose Mountain Creek | above Grant Devine Lake | Saskatchewan | Environment and Climate Change Canada |
| 05ND011 | Shepherd Creek | near Alameda | Saskatchewan | Environment and Climate Change Canada |

**Table 1.** (Continued)

| Index Number | Stream | Location | State or Province | Operated by |
|---|---|---|---|---|
| 05ND013 | Moose Mountain Creek | below Grant Devine Lake | Saskatchewan | Environment and Climate Change Canada |
| 05NE003 | Pipestone Creek | above Moose Mountain Reservoir | Saskatchewan | Environment and Climate Change Canada |
| 05NF001 | Souris River | at Melita | Manitoba | Environment and Climate Change Canada |
| 05NF002 | Antler River | near Melita | Manitoba | Environment and Climate Change Canada |
| 05NF006 | Lightning Creek | near Carnduff | Saskatchewan | Environment and Climate Change Canada |
| 05NF007 | Gainsborough Creek | near Lyleton | Manitoba | Environment and Climate Change Canada |
| 05NF008 | Graham Creek | near Melita | Manitoba | Environment and Climate Change Canada |
| 05NF010 | Antler River | near Wauchope | Saskatchewan | Environment and Climate Change Canada |
| 05NG001 | Souris River | at Wawanesa | Manitoba | Environment and Climate Change Canada |
| 05NG003 | Pipestone Creek | near Pipestone | Manitoba | Environment and Climate Change Canada |
| 05NG007 | Plum Creek | near Souris | Manitoba | Environment and Climate Change Canada |
| 05NG012 | Elgin Creek | near Souris | Manitoba | Environment and Climate Change Canada |
| 05NG020 | Medora Creek | near Napinka | Manitoba | Environment and Climate Change Canada |
| 05NG021 | Souris River | at Souris | Manitoba | Environment and Climate Change Canada |
| 05NG024 | Pipestone Creek | near Sask. Boundary | Manitoba | Environment and Climate Change Canada |
| 5113520 | Long Creek Tributary | near Crosby | North Dakota | United States Geological Survey |
| 5113600 (05NB027) | Long Creek[1 3] | near Noonan | North Dakota | United States Geological Survey |
| 5114000 (05ND007) | Souris River[1 3] | near Sherwood | North Dakota | United States Geological Survey |
| 5116000 | Souris River[3] | near Foxholm | North Dakota | United States Geological Survey |
| 5116135 | Tasker Coulee Tributary | near Kenaston | North Dakota | United States Geological Survey |
| 5116500 | Des Lacs River[3] | at Foxholm | North Dakota | United States Geological Survey |
| 5117500 | Souris River[3] | above Minot | North Dakota | United States Geological Survey |
| 5119410 | Bonnes Coulee | near Velva | North Dakota | United States Geological Survey |
| 5120000 | Souris River[3] | near Verendrye | North Dakota | United States Geological Survey |
| 5120180 | Wintering River Tributary | near Kongsberg | North Dakota | United States Geological Survey |
| 5120500 | Wintering River[3] | near Karlsruhe | North Dakota | United States Geological Survey |
| 5122000 | Souris River[3] | near Bantry | North Dakota | United States Geological Survey |
| 5123300 | Oak Creek Tributary | near Bottineau | North Dakota | United States Geological Survey |
| 5123400 | Willow Creek[3] | near Willow City | North Dakota | United States Geological Survey |
| 5123510 | Deep River[3] | near Upham | North Dakota | United States Geological Survey |
| 5124000 (05NF012) | Souris River[1 3] | near Westhope | North Dakota | United States Geological Survey |

**Table 2.** Water level stations in the Souris River Basin

| Index Number | Stream | Location | State or Province | Operated by |
|---|---|---|---|---|
| 5113750 | East Branch Short Creek Reservoir | near Columbus | North Dakota | United States Geological Survey |
| 5115500 | Lake Darling | near Foxholm | North Dakota | United States Geological Survey |
| LGNN8 | Souris River | at Logan | North Dakota | United States Army Corps of Engineers<br>United States National Weather Service |
| SWRN8 | Souris River | at Sawyer | North Dakota | United States Army Corps of Engineers<br>United States National Weather Service |
| TOWN8 | Souris River | at Towner | North Dakota | United States Army Corps of Engineers<br>United States National Weather Service |
| VLVN8 | Souris River | at Velva | North Dakota | United States Army Corps of Engineers<br>United States National Weather Service |
| | Upper Souris Refuge | Dams 87 and 96 | North Dakota | United States Fish and Wildlife Service |
| | Des Lacs Refuge | Units 1 - 8 inclusive | North Dakota | United States Fish and Wildlife Service |
| | J. Clark Salyer Refuge | Dams 320, 326, 332, 341, and 357 | North Dakota | United States Fish and Wildlife Service |
| 05NA006 | Larsen Reservoir | near Radville | Saskatchewan | Environment and Climate Change Canada |
| 05NB012 | Boundary Reservoir | near Estevan | Saskatchewan | Saskatchewan Water Security Agency |
| 05NB016 | Roughbark Reservoir | near Weyburn | Saskatchewan | Environment and Climate Change Canada |
| 05NB020 | Nickle Lake | near Weyburn | Saskatchewan | Environment and Climate Change Canada |
| 05NB032 | Rafferty Reservoir | near Estevan | Saskatchewan | Environment and Climate Change Canada |
| 05NC002 | Moose Mountain Lake | near Corning | Saskatchewan | Environment and Climate Change Canada |
| 05ND008 | White Bear (Carlyle) Lake | near Carlyle | Saskatchewan | Saskatchewan Water Security Agency |
| 05ND009 | Kenosee Lake | near Carlyle | Saskatchewan | Saskatchewan Water Security Agency |
| 05ND012 | Grant Devine Lake | near Alameda | Saskatchewan | Environment and Climate Change Canada |
| 05NE002 | Moosomin Lake | near Moosomin | Saskatchewan | Environment and Climate Change Canada |
| 05NF804 | Metigoshe Lake | near Metigoshe | Manitoba | Manitoba Infrastructure |
| 05NF805 | Sharpe Lake | near Deloraine | Manitoba | Manitoba Infrastructure |
| 05NG023 | Whitewater Lake | near Boissevain | Manitoba | Environment and Climate Change Canada |
| 05NG801 | Plum Lake | above Deleau Dam | Manitoba | Manitoba Infrastructure |
| 05NG803 | Elgin Reservoir | near Elgin | Manitoba | Manitoba Infrastructure |
| 05NG806 | Souris River | above Hartney Dam | Manitoba | Manitoba Infrastructure |
| 05NG807 | Souris River | above Napinka Dam | Manitoba | Manitoba Infrastructure |
| 05NG809 | Plum Lake | near Findlay | Manitoba | Manitoba Infrastructure |
| 05NG813 | Oak Lake | at Oak Lake Resort | Manitoba | Manitoba Infrastructure |
| 05NG814 | Deloraine Reservoir | near Deloraine | Manitoba | Manitoba Infrastructure |

**Table 3.** Water quality stations in the Souris River Basin

| Index Number | Stream | Location | State or Province | Operated by |
|---|---|---|---|---|
| 5114000 (05ND007) | Souris River[1 3] | near Sherwood | North Dakota | United States Geological Survey |
| 5115500 | Lake Darling | near Foxholm | North Dakota | United States Geological Survey |
| 5116000 | Souris River[3] | near Foxholm | North Dakota | United States Geological Survey |
| 5116500 (380021) | Des Lacs River[3] | at Foxholm | North Dakota | United States Geological Survey and North Dakota Department of Health |
| 5117500 (380161) | Souris River[3] | above Minot | North Dakota | United States Geological Survey and North Dakota Department of Health |
| 5120000 (380095) | Souris River[3] | near Verendrye | North Dakota | United States Geological Survey and North Dakota Department of Health |
| 5122000 | Souris River[3] | near Bantry | North Dakota | United States Geological Survey |
| 5123400 | Willow Creek[3] | near Willow City | North Dakota | United States Geological Survey |
| 5123510 | Deep River[3] | near Upham | North Dakota | United States Geological Survey |
| | J. Clark Salyer Refuge | Pool 357 | North Dakota | United States Fish and Wildlife Service |
| 5124000 (05NF012) | Souris River[1 3] | near Westhope (QA) | North Dakota | United States Geological Survey Environment and Climate Change Canada |
| MB05NGS003 | Souris River | near Treesbank (PR #530) | Manitoba | Manitoba Sustainable Development |
| MB05NGS004 | Souris River | at Souris (PTH #22) | Manitoba | Manitoba Sustainable Development |
| MB05NFS024 | Souris River | near Melita (PTH #3) | Manitoba | Manitoba Sustainable Development |
| MB05NGS079 | Pipestone Creek | near Kola (PR #257) | Manitoba | Manitoba Sustainable Development |
| MB05NGS026 | Pipestone Creek | at diversion (Mile Rd 150 W) | Manitoba | Manitoba Sustainable Development |

1 International gauging station
2 Formerly published as Souris River below Lewvan
3 Operated jointly for hydrometric and water-quality monitoring

## 6.0 TRANSBOUNDARY WATER QUALITY OBJECTIVES AND MONITORING

The water quality of the Souris River at the International Boundary has been monitored by the International Souris River Board (formerly the Souris River Bilateral Water Quality Monitoring Group) since 1990. The two sites are located at the river crossing of the Saskatchewan/North Dakota border near Sherwood, ND (samples collected and analyzed by the USGS), and at the North Dakota/Manitoba border near Westhope, ND (samples collected and analyzed by ECCC).

The Aquatic Ecosystem Health Committee (AEHC) oversees water quality monitoring activities, including making recommendations for sampling, ensuring data integrity and undertaking data analysis. In 2018 the AEHC met in person once and held two conference calls to discuss work plans and to formulate action items for the next year. A committee meeting was held on June 25 to review the activities of the AEHC.

AEHC members developed a project proposal for an International Watershed Initiative (IWI) grant through the International Joint Commission (IJC). The proposal was accepted and will consist of installing continuous dissolved oxygen/temperature monitoring sensors at three sites along the Souris River, with the purpose of analyzing diurnal and seasonal variations and to determine possible correlations to flow. Sites are co-located with USGS gaging stations to provide the discharge information.

AEHC members also participated in the International Souris River Study Board's (ISRSB) Water Quality Performance Indicators Group through several emails and calls. Parameters for use in indicators were selected and existing data summarized. USGS undertook analyses to compare flow-concentration and seasonal trends on thirteen water quality parameters. The goal was to determine which parameters could be used as performance indicators to evaluate the effect of operational changes (flow) on water quality. The group selected five parameters for use as a water quality indicator and relationships between flow and water quality were provided to the ISRSB. As a result of these discussions, it was determined that the AEHC should develop an IWI grant to conduct an in-depth trend analysis of study of water quality parameters throughout the Souris River basin.

## 6.1 OVERVIEW OF WATER QUALITY

The water quality of the Souris River at the International Boundary has been monitored by the International Souris River Board (formerly the Souris River Bilateral Water Quality Monitoring Group) since 1990. The two sites are located at the river crossing of the Saskatchewan/North Dakota border near Sherwood, ND (samples collected and analyzed by the USGS), and at the North Dakota/Manitoba border near Westhope, ND (samples collected and analyzed by ECCC).

Water quality objectives are established for the two border crossings. When water quality objectives are not achieved, such conditions are referred to as "exceedances". A summary of water quality exceedances for 2018, along with historical data, is reported in Appendix E.

Historically, the principal concerns regarding water quality exceedances in the Souris River basin are related to high total dissolved solids (TDS), low dissolved oxygen, and high levels of nutrients, especially phosphorus. High TDS generally increases the hardness of water and can cause scale build up in pipes and filters. At higher levels, TDS can also affect aquatic life, especially spawning fish and juveniles. However, higher levels of TDS are common on prairies.

Low dissolved oxygen levels can result in the death of fish and other aquatic life and mobilize trace metals. High phosphorus concentrations can cause algae blooms, which, depending on how blooms form and ultimately decompose, can lead to reductions in dissolved oxygen. High nutrient levels are also associated with the greater prevalence of cyanobacteria (blue- green algae), which under certain conditions can produce toxins that are harmful to humans and animals.

At the Saskatchewan/North Dakota border crossing in Sherwood, the United States Geological Survey (USGS) conducted water quality sampling eight times in 2018. However, one of the samples was lost in transit to the lab, so seven samples were used in the calculations. At the North Dakota/ Manitoba border crossing near Westhope, the USGS collected one sample in 2018 simultaneously with Environment and Climate Change Canada to compare sampling methods. Environment and Climate Change Canada conducted water quality sampling eight times in 2018 at the North Dakota/Manitoba border crossing.

**Sherwood Site**

For the Sherwood site, where the Souris River crosses the border from Saskatchewan into North Dakota, water quality was compared to the four years previous to 2018. Compared to previous years, the median and maximum values continue to decline for many metals (beryllium, cadmium, chromium, cobalt, copper, zinc, iron and lead), with concentrations of iron and lead decreasing. Of all metals only iron concentrations exceeded the water quality objective established at Sherwood, although its median 2018 concentration of 530 ug/L was also lower than the median value of 1,860 µg/L in 2013.

Median concentrations of sodium increased over the last five years and the frequency of exceedances increased as compared to previous years, with 85.7 percent of the 2018 samples exceeding the objective. While maximum sulphate concentrations have decreased over time, median concentrations are higher than in previous years. There was a 28.6 percent exceedance of total dissolved solids, which was an increase in exceedances from last year.

This is the sixth year *E. coli* bacteria samples have been analyzed, and while densities are below the proposed Water Quality Objective, the geomean has been increasing since collection of E coli was initiated six years ago.

*E. coli* did not exceed the single day water quality objective of 400 colonies per 100 ml. The seasonal geomean, however, of 126 colonies per 100 ml was exceeded (Appendix E).

While dissolved oxygen has not met its objective during certain times of the year, this year concentrations were above the water quality objective for all samples. Dissolved Oxygen concentrations ranged from 6.4 to 11.9 mg/l. Concentrations of less than 5.0 mg/L are considered to not meet the water quality objective. The median and maximum concentrations for phosphorus and nitrogen in 2018 were similar to the historic median and maximum concentrations, with total phosphorus exceeding the water quality objective 100 percent of the time.

Pesticide samples were also collected as a part of an intensive statewide independent study conducted by the North Dakota Department of Agriculture. Ninety-eight pesticides were tested, and none were above the water quality objectives, or for those not part of routine testing, none were above either aquatic life benchmarks or human health limits. Three pesticides (2,4-D, Atrazine, and MPCA) were detected. When analyzing data for this report, the Historic Data column in the appendix only includes 5 years of data from 2013 to 2018.

**Westhope Site**

For the Westhope site, where the Souris River crosses from North Dakota into Manitoba, exceedances of water quality objectives for nutrients, major ions, and metals included boron, total phosphorus, sodium, sulphate, total dissolved solids, total suspended solids, and total iron. Total phosphorus did not meet water quality objectives in any of the eight samples. Sodium also exceeded the water quality objective in all 8 samples. Sulphate exceedance rate was 50%. The iron objective was exceeded in all eight samples (100%) in 2018.

Reportable physical and other parameters include dissolved oxygen, pH, total suspended solids, and total dissolved solids. Among these parameters, pH exceeded the upper objective three times in 2018, but these values are consistent with historical data for the Westhope site. Oxygen fell below the minimum objective of 5.0 mg/L twice, in under ice conditions in January and February. This may be related to minimal flow during the winter. There were 8 TSS (100%) and 4 TDS (50%) exceedances. High TDS occurred under ice in January and February, and during April/May runoff.

Biological parameters monitored include fecal coliform and *E. coli* bacteria. Fecal coliform bacteria did not exceed the 200 colonies per 100 ml objective. *E. coli* did not exceed the single day water quality objective of 400 colonies per 100 ml or the seasonal geomean of 126 colonies per 100 ml (Appendix E).

Pesticide samples were collected at Westhope by Environment and Climate Change Canada between April and September. Forty-nine pesticide parameters were analyzed. Of the pesticides with Souris River objectives, 2,4-D, Atrazine, Bromoxynil, Dicamba, MCPA, and Picloram were detected. These detections were at levels well below their water quality objectives.

## 6.2 CHANGES TO POLLUTION SOURCES IN 2018

Development in the Saskatchewan/North Dakota region of the basin in connection with oil in the Bakken Formation has the potential to increase areas that are susceptible to erosion. However, 2015 and 2018 saw decreasing growth of the oil and gas industry in this area. The continuing decrease in oil prices lead to fewer new wells being constructed and most of the production moving south, out of the Souris River basin to a more cost-effective portion of the Bakken formation.

Oil development and production has the potential of increasing storm water pollution through increases in erosion and can cause a variety of water quality impairments if mitigation practices are not followed. However, the most prevalent source of pollution is still nonpoint source pollution arising from other sources.

The Souris River basin typically experiences short duration but intense precipitation during the spring and early summer months. These storms can cause overland flooding and rising river levels. Cropping practices that don’t use soil and water conservation methods and livestock grazing near and watering in the river are likely sources of nutrient, sediment, and E. coli bacteria concentrations, along with contributing to oxygen depletion. However, this has been lessened in recent years by the installation of animal waste systems and implementation of

Beneficial Management Practices on agricultural land through a variety of watershed improvement projects throughout the basin on both sides of the border.

Point source pollution from the city of Minot has been reduced by updating from a basic lagoon system to a more advanced system that includes aeration basins to do the initial breakdown of waste, and a wetland system at the end of the treatment train to help further reduce nutrient loads to the river. While smaller cities are permitted to allow lagoon discharge into the river, many have not discharged in decades, and a majority of the rest only do so once or twice a year. None are continual dischargers. All permitted wastewater treatment lagoons in North Dakota are required in their permit to meet the State's water quality standards at the point of discharge. These standards are protective of the objectives set up by the International Souris River Board (ISRB). While the ISRB has numeric objectives set for nitrogen and phosphorus, the state of North Dakota does not currently have numeric nutrient water quality standards, so there are no discharge permit limitations on nitrogen or phosphorus. However, the North Dakota Department of Environmental Quality Permits Program is working with major treatment systems like Minot and selected minor treatment systems to collect data on nutrient levels in discharges. This data will be used to evaluate the contributions of wastewater treatment systems to the nutrient loading of the receiving waterbody and assist in the development of numeric nutrient criteria for water quality standards in the future.

The city of Estevan has no waste water discharge to the Souris River. The city's wastewater treatment plant flow is directed to the Shand Power Station as makeup water for cooling processes. The Shand plant is designed to operate without wastewater outfall.

Future impacts to water quality and aquatic ecosystem health could be caused by changing agricultural activities and landscape, urban development, energy development, and water appropriations that reduce flows.

## 6.3 CHANGES TO MONITORING

Changes to the monitoring plan for 2019 include sampling for neonicotinoid pesticides and an adjustment to sample timing at Westhope, and the new International Watershed Initiative project to continuously monitor dissolved oxygen and temperature at Sherwood, Minot and Westhope. The 2019 monitoring plan can be found in Appendix F.

As a result of an International Watershed Initiative grant awarded by the International Joint Commission, Xylem (YSI) EXO sondes will be installed at three locations to measure water temperature and dissolved oxygen (DO) at 15-minute intervals and transmit these data every hour to the USGS. The sondes will be installed at current hydrometric stations to ensure flow effects on DO can be accurately evaluated. Locations for deployment on the Souris River will be the station near Sherwood, ND (station number 05114000) to monitor conditions at the international border below the Saskatchewan reservoirs, at the station above Minot, ND (station number 05117500) which is below Lake Darling, part of the Souris River Basin NWR Complex operated by the US Fish and Wildlife Service, to monitor the conditions below that reservoir, and near Westhope, ND (station number 02154000) to monitor the conditions after a series of impoundments at the J. Clark Salyer National Wildlife Refuge (also part of the Souris River Basin NWR Complex) before the river enters Manitoba. The continuous sensors will be serviced every three weeks or on a more frequent basis if necessary, to check the calibration of the

instruments and remove any fouling that may occur). Continuous data will be regularly quality assured to make adjustments for calibration and fouling from information collected during site visits. Collected data will be publicly available in real-time from the USGS website (http://waterdata.usgs.gov/nd/nwis/).

## 6.4 WINTER ANOXIA

Winter hypoxia and anoxia and associated fish kills are the result of low concentrations of dissolved oxygen that have been documented in the Souris River on many occasions in previous years. Factors contributing to low oxygen concentrations have not been definitively determined, but are assumed to be due to sediment oxygen demand and a low volume of liquid water between the ice and sediment (as determined in North Dakota's 2010 Total Maximum Daily Load report on the reach of the Souris River from Sherwood to Lake Darling), low flow conditions, macrophyte decomposition, photosynthesis suppression under ice and snow, and scouring of low head dams during high flow events.

Dissolved oxygen concentrations at Sherwood met the water quality objective of 5.0 milligrams per litre for all samples throughout 2018. This was the sixth consecutive year when the objective was met throughout the entire year. At Westhope, two low oxygen events occurred, in January and February. Results from the recently funded IWI project will provide new insight into dissolved oxygen concentrations in the Souris River including diurnal and seasonal variations and possible correlations to flow.

## 7.0 WATER DEVELOPMENT ACTIVITIES IN 2018

## 7.1 NORTHWEST AREA WATER SUPPLY PROJECT

The Northwest Area Water Supply (NAWS) project was authorized by the Garrison Diversion Reformulation Act of 1986 and the Dakota Water Resources Act of 2000 under the Municipal, Rural, and Industrial (MR&I) Grant Program. NAWS is a water supply project designed to service a project area of 81,000 people using water from Lake Sakakawea supplied through a pipeline to the City of Minot.

In 1991, the state passed into law a bill creating the NAWS Advisory Committee, while giving the NDSWC the authority to construct, operate, and manage the project. Construction of NAWS began on April 5, 2002, with a main line and associated features being built between the City of Minot and Lake Sakakawea.

An Environmental Assessment (EA) was completed in 2001 and a Finding of No Significant Impact was issued in 2002. Construction of the pipeline between Minot and Lake Sakakawea began in April of 2002. In October of 2002, a legal challenge was filed by the Province of Manitoba, Canada to stop the construction of NAWS, claiming the EA conducted for the project was inadequate under the National Environmental Policy Act (NEPA). Manitoba's specific main concern was the potential for inter-basin transfer of invasive species. The District Court for the District of Columbia ruled in favor of Manitoba in 2005, remanding the project back to the Bureau of Reclamation (Reclamation) for further environmental review, specifically addressing likelihood of transfer of invasive species by the project and treatment technologies to prevent it. The Court also placed an injunction of the project limiting construction activities that may affect the treatment process used prior to crossing the continental divide.

An Environmental Impact Statement was completed in 2009. The State of Missouri, whose primary concern was depletions on the Missouri River system, had joined the lawsuit by this time. The District Court determined the EIS to be insufficient and remanded the case back to Reclamation for further environmental review, specifically to address impacts of the potential transfer of invasive species in Canada, and impacts to the Missouri River system. A Supplemental Environmental Impact Statement was completed in 2015. Reclamation pursued comprehensive environmental assessments and investigations of the potential risks and consequences related to inter-basin water transfer as well as impacts to the Missouri River. The District Court ruled that the Bureau had fulfilled their NEPA obligations in 2017, denying Manitoba's motion for further environmental review and dismissing Missouri's complaint for a lack of standing in the case. The Court also vacated the injunction that had been on the project since 2005.

The 2017 ruling was appealed by Manitoba and Missouri. Manitoba's main interest for the appeal was to be included in the ongoing progression of the project. Manitoba dropped their appeal after the Reclamation agreed to set up an Adaptive Management Team that would be involved in the construction and operation of the Biota Water Treatment Plant that would treat the Missouri River Basin water prior to it entering the Hudson Bay Basin. The level of water treatment that Manitoba requested and received is that of potable water. The Adaptive Management Team would also have a role in the development of emergency response measures, treatment monitoring, disruption contingency plans, and ongoing operation procedures. The

memorandum of understanding executed prior to Manitoba withdrawing their appeal defined the role of the team and its composition. Missouri continued its appeal.

## 7.2 CANADIAN DAM SAFETY

WSA completed a new Probable Maximum Flood (PMF) study after the 2011 flood event. These results are detailed in "Final Report for Probable Maximum Flood, Rafferty and Alameda Dams," which was completed by HATCH in December of 2014. The study found that the PMF was the result of a rainfall-runoff event and was much larger than the previous PMF event used to size the reservoirs. Additional work was completed to rationalize a new Inflow Design Flood (IDF) using the CDA guidelines. This information was detailed in the report "Final Report for Alameda and Rafferty Dams IDF Study" completed by HATCH in August of 2016.

The IDF was defined as one-third of the difference between the 1:1000-year inflow event and the PMF for each reservoir. To route these IDF hydrographs through the reservoirs without exceeding the Maximum Allowable Flood Levels and outflow constraints, it was determined that Rafferty must be at or below 551.5 m (1809.4 ft), one meter above FSL, and Grant Devine must be at or below 561.0 m (1840.5 ft), equal to FSL. WSA referred to these levels as the Inflow Design Flood Service Level (IDFSL) and would need to maintain the reservoirs below these levels in June and July to mitigate the dam safety risk. Drawing down to IDFSL following a significant snowmelt runoff event may require the target flows at the Sherwood Crossing, which is outlined in the 1989 Agreement, to be exceeded.

Another limitation is the 320 cms (11,301 cfs) outflow limitation at Grant Devine Dam due to the potential for high tailwater elevations threatening the integrity of the spillway. These high tailwater elevations are due to the limited capacity of a crossing through the downstream railway embankment.

WSA is developing Reservoir Operation Manuals to establish a set of operating rules to be used to ensure that dam safety risk is managed. These manuals would meet the requirements for Reservoir Regulation Manuals, that were identified in the 1989 Agreement to manage summer rainfall events.

WSA is also investigating structural solutions to mitigate risks and allow the dams and reservoirs to operate to their full design. WSA expressed that it is committed to keeping the ISRB informed on this issue and told the Board that WSA is consulting with the USACE.

## 7.3 WATER APPROPRIATIONS

### 7.3.1 BACKGROUND

In 1995, the Board adopted a new method for reporting minor project diversions for the purpose of determining apportionment. The new method uses a common set of criteria and ensures that the same criteria are used in Saskatchewan and North Dakota. The method involves reviewing the project lists generated by the Natural Flow Methods Committee and adding newly constructed projects or subtracting cancelled projects each year. The projects that met the criteria in 1993 are used as the benchmark for all future reporting.

### 7.3.2 SASKATCHEWAN

In 1993 there were 137 minor projects in the Saskatchewan portion of the Souris River Basin that met the 1995 criteria. These projects had an annual diversion of 5,099 cubic decameters (4,134 acre-feet).

In 2018, water appropriation change decreased the total allocations by 366 cubic decameters (297 acre-feet).

### 7.3.3 NORTH DAKOTA

In 1993 there were 12 minor projects in the North Dakota portion of the Souris River basin upstream of Sherwood that met the 1995 criteria. The projects had an annual diversion of 1,257 cubic decametres (1,019 acre-feet). As of December 31, 2018, there were 13 minor projects in the North Dakota portion of the Long and Short Creek basins. The annual diversions totaled 1,543 cubic decametres (1,251 acre-feet).

## 8.0 HYDROLOGIC CONDITIONS IN 2018

The 2018 spring runoff forecast was well below normal on February 15, 2018. There was significantly well below normal-precipitation from April 1 to October 1, 2017 over the western portion of the basin. It was also reported that portions of the basin experienced 40 to 60 percent of normal fall precipitation from September to November, 2017. These dry antecedent conditions and below normal winter snow pack resulted in below normal streamflow and inflows to reservoirs in 2018.

The total volume of flow past Long Creek at the western crossing, upstream of Boundary Reservoir, for the 2018 calendar year was 4,058 acre-feet (5,006 cubic decametres). This volume was approximately 16 percent of the long-term mean of 24,691 acre-feet (30,456 cubic decametres) over the past 60 years.

Table 4 provides the total annual inflow for Boundary, Rafferty, Grant Devine, and Darling Reservoirs for 2018, as well as the year-end elevations and change in elevation from January 1 to December 31, 2018.

**Table 4.** 2018 dam statistics

| Reservoir | Inflow<br>cubic decametres (acre-feet) | End of Year Elevation<br>meters (feet) | Elevation Change<br>meters (feet) |
|---|---|---|---|
| Boundary | 6,952 (5,636) | 558.8 (1,833.4) | -0.5 (-1.8) |
| Rafferty | 4,368 (3,541) | 549.2 (1,801.9) | -0.3 (-1.0) |
| Grant Devine | 10,491 (8,505) | 561.1 (1,840.9) | 0.0 (0.0) |
| Lake Darling | 55,422 (44,931) | 486.4 (1,595.9) | -0.2 (-0.7) |

On December 31, 2018, the estimated storage in the five major reservoirs in Saskatchewan (Boundary, Rafferty, Grant Devine, Nickle Lake, and Moose Mountain Lake) was 546,270 cubic decametres (442,861 acre-feet) as compared to storage of 560,771 cubic decametres (454,617 acre-feet) on December 31, 2017. Figure 1 shows the storage contents of the major reservoirs in the Canadian portion of the Souris River Basin for 2017 and 2018.

Recorded runoff for 2018 for the Souris River near Sherwood was 55,422 cubic decametres (44,931 acre-feet), or about 35 percent of the 1931-2018 long-term mean.

The artificially drained areas of Yellow Grass Ditch and Tatagwa Lake contributed 3,441 cubic decametres (2,790 acre-feet) to the Sherwood crossing during 2018.

Figure 2 provides a schematic representation of recorded runoff above Sherwood, North Dakota.

Figure 3 illustrates the monthly releases from Boundary, Rafferty, Grant Devine, and Lake Darling reservoirs, which contribute to flows at the J. Clark Salyer National Wildlife Refuge.

The 2018 year-end storage in the J. Clark Salyer National Wildlife Refuge pools was 40,438 cubic decametres (32,783 acre-feet), or 9,876 cubic decametres (7,996 acre-feet) less than on December 31, 2017. The combined year-end storage in Lake Darling and the J. Clark Salyer Refuge pools was 170,576 cubic decametres (138,286 acre-feet), well above the 66,600 cubic

decametres (54,000 acre-feet) severe drought criterion. Figure 4 shows the storage contents of the mainstem reservoirs in the United States.

Flows leaving J. Clark Salyer National Wildlife Refuge enter Manitoba and were recorded at the Westhope gage. Recorded runoff for the year for the Souris River at Westhope was 45,209 cubic decametres (36,651 acre-feet) or some 10,213 cubic decametres (8,280 acre-feet) less than the volume that entered North Dakota at the Sherwood Crossing. The minimum flow for the period was zero cms (zero cfs). The peak discharge for the period January 1 to December 31, 2018 was 3.48 cms (123 cfs) which occurred on May 9th.

## 9.0 SUMMARY OF FLOWS AND DIVERSIONS

### 9.1 SOURIS RIVER NEAR SHERWOOD

The natural runoff near Sherwood for 2018 was 55,422 cubic decametres (44,931 acre-feet). Depletions in Canada were 20,058 cubic decametres (16,261 acre-feet). The additional water received from the Yellow Grass Ditch and Tatagwa Lake Drain basins was 3,441 cubic decametres (2,790 acre-feet). Total depletions in Canada were 16,617 cubic decametres (13,471 acre-feet) more than the additional water received from the Yellow Grass Ditch and Tatagwa Lake Drain Basins. The total volume of water released from Boundary, Rafferty, and Grant Devine reservoirs in Canada in 2018 was 51,633 cubic decametres (41,859 acre-feet), representing 63 percent of the recorded flow at Sherwood, or 93 percent of the computed natural runoff at Sherwood.

The summary of the natural flow computations is provided in Appendix A. Saskatchewan was in surplus by 13,194 cubic decametres (10,696 acre-feet) on December 31, 2018.

The flow of the Souris River at Sherwood was more than 0.113 cms (4 cfs) for the entire year. Accordingly, Saskatchewan complied with the 0.113 cms (4 cfs) provision specified in Recommendation No. 1 of the Interim Measures.

### 9.2 LONG CREEK AND SHORT CREEK

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 5,006 cubic decametres (4,058 acre-feet), or 16 percent of the long-term mean since 1959.

Recommendation No. 2 of the Interim Measures was met. The increase in runoff on Long Creek between the Western and Eastern Crossings was 1,946 cubic decametres (1,578 acre-feet).

Short Creek, which rises in North Dakota, contributed 4,276 cubic decametres (3,467 acre-feet) to the runoff recorded at Souris River above Sherwood.

### 9.3 SOURIS RIVER NEAR WESTHOPE

Recorded flow near Westhope during the period of June 1 through October 31, 2018, was 37,583 cubic decametres (30,469 acre-feet). Figure 5 illustrates the recorded flows at Westhope and at Wawanesa near the mouth of the Souris River in Manitoba.

According to the USGS, flows recorded at the Souris River near Westhope gage through the December 31, 2018 calendar year were 45,538 cubic decametres (36,918 acre-feet).

The flow at Westhope was not in compliance with the 0.566 cms (20 cfs) minimum flow requirement as specified in Recommendation No. 3(a) of the Interim Measures for the period of August 25 to 26, September 2, and September 4 to 5.

## 10.0 WORKPLAN SUMMARY FOR 2018

The Board was created by the IJC in April 2000 when the IJC combined responsibilities previously assigned under two separate references for the Souris River. The previous references were the International Souris River Board of Control Reference (1959) and the Souris-Red Rivers Engineering Board Reference (1948).

On June 9, 2005, the Board's mandate was further revised through an exchange of diplomatic notes, assigning water quality functions and the oversight for flood forecasting and operations to the Board. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations was an important step in the evolution of the Board as it moved towards an integrated approach to transboundary water issues in the Souris River Basin.

An updated workplan with input from the committees was supplied to the Board during their June, 2018 meeting (Appendix H). The draft workplan was built around the 2007 directive and included key items such as overseeing implementation and compliance of the apportionment measures, the oversight function for flood operations, the joint water quality monitoring program and AEHC, providing public involvement opportunities, and maintaining awareness of proposed and existing developments.

**Figure 1.** Month end contents of reservoirs in Canada for the years 2017 and 2018.

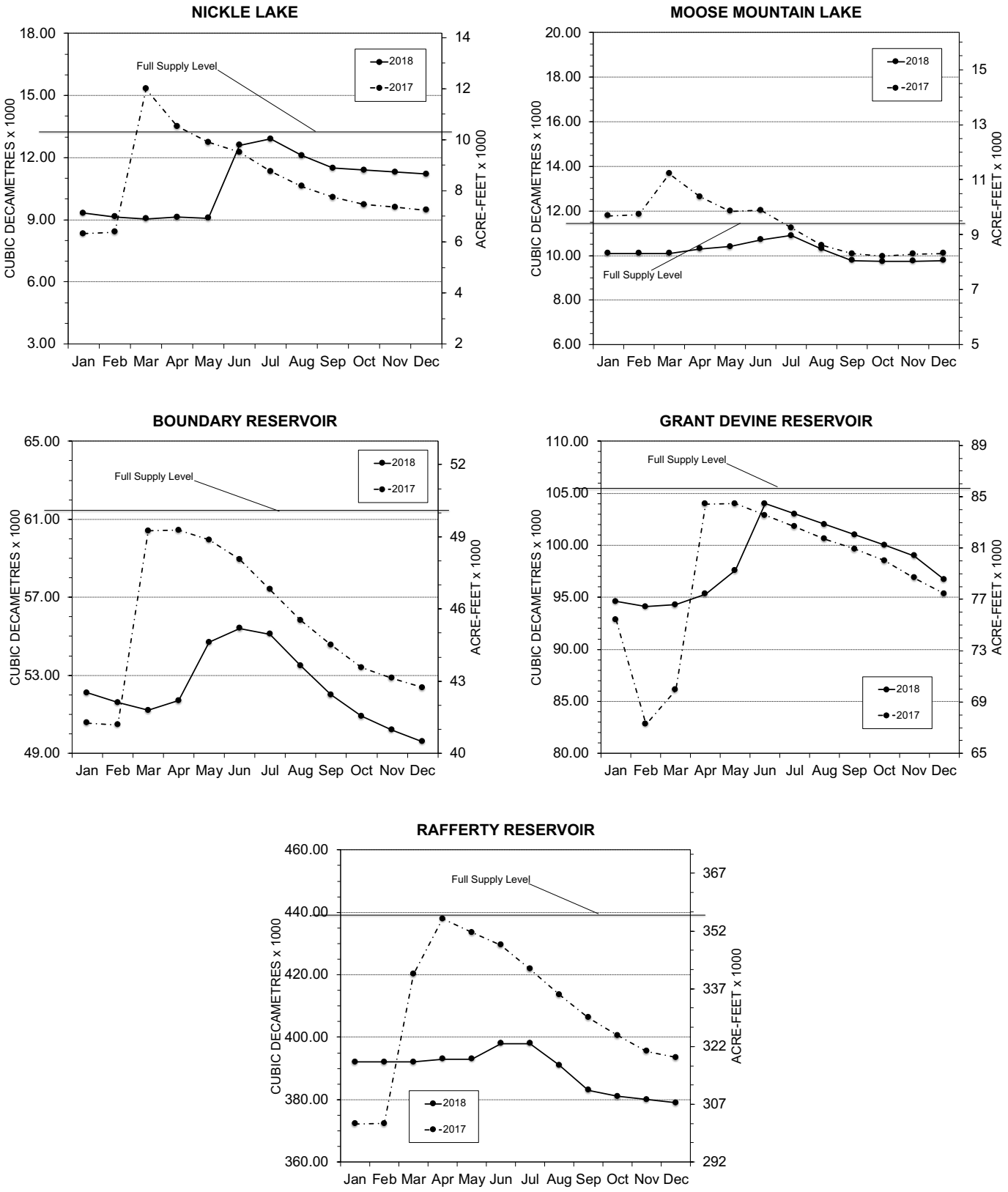


**Figure 2.** Schematic representation of 2018 flows in the Souris River Basin above Sherwood, North Dakota, U.S.A.

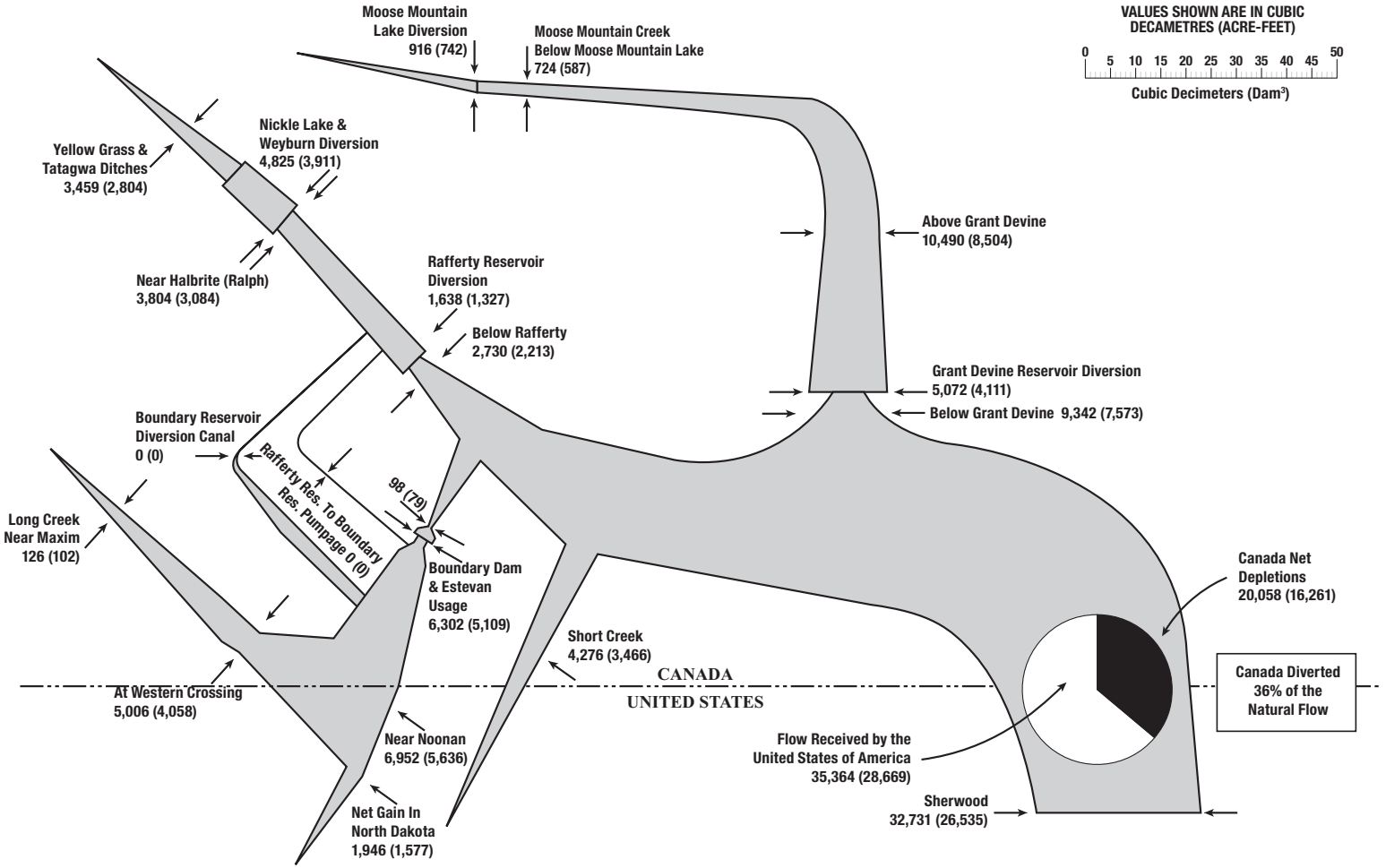


**Figure 3.** Month end contents of reservoirs in U.S.A. for the years 2017 and 2018.

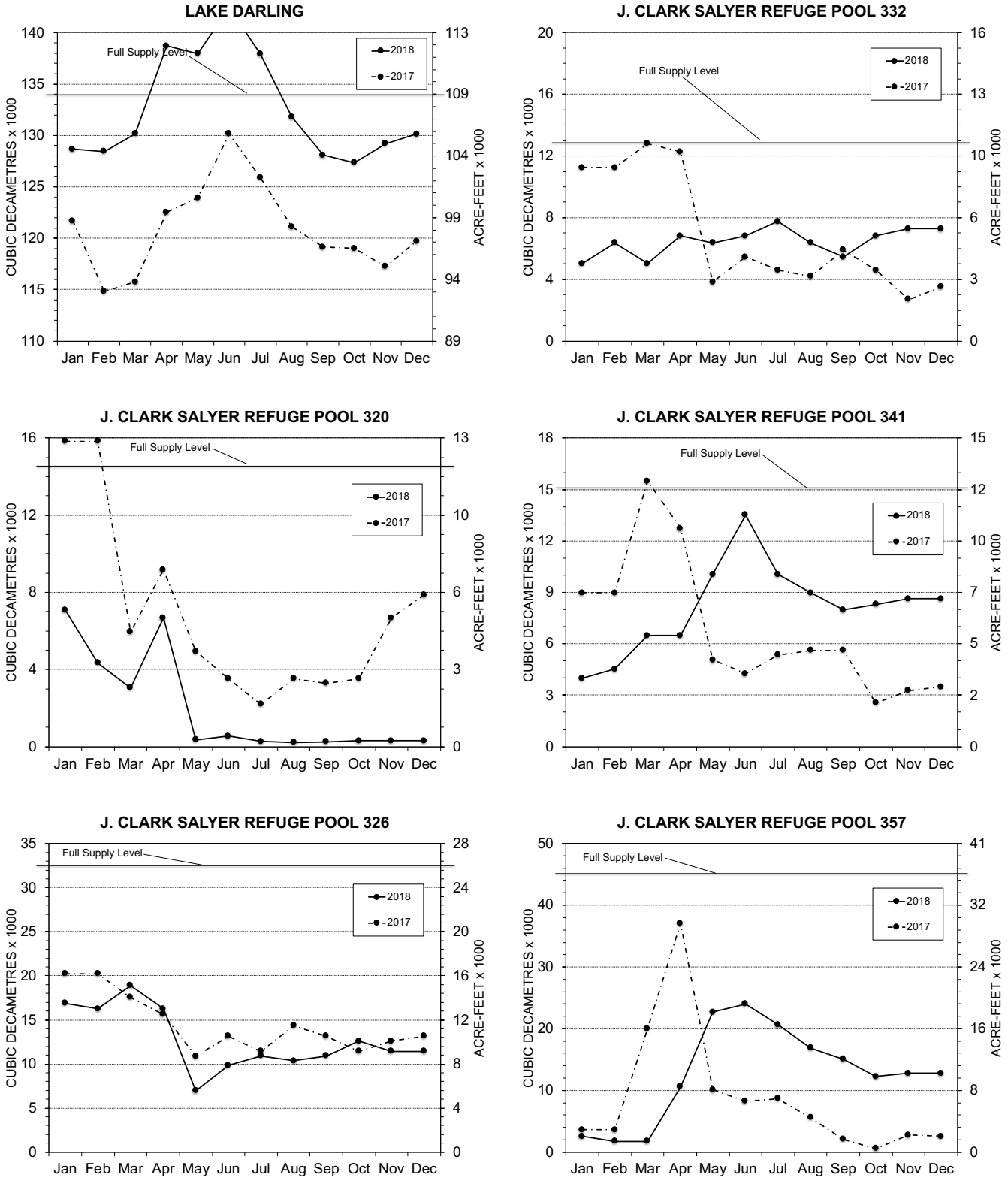


**Figure 4.** Monthly reservoir releases for the year 2018.

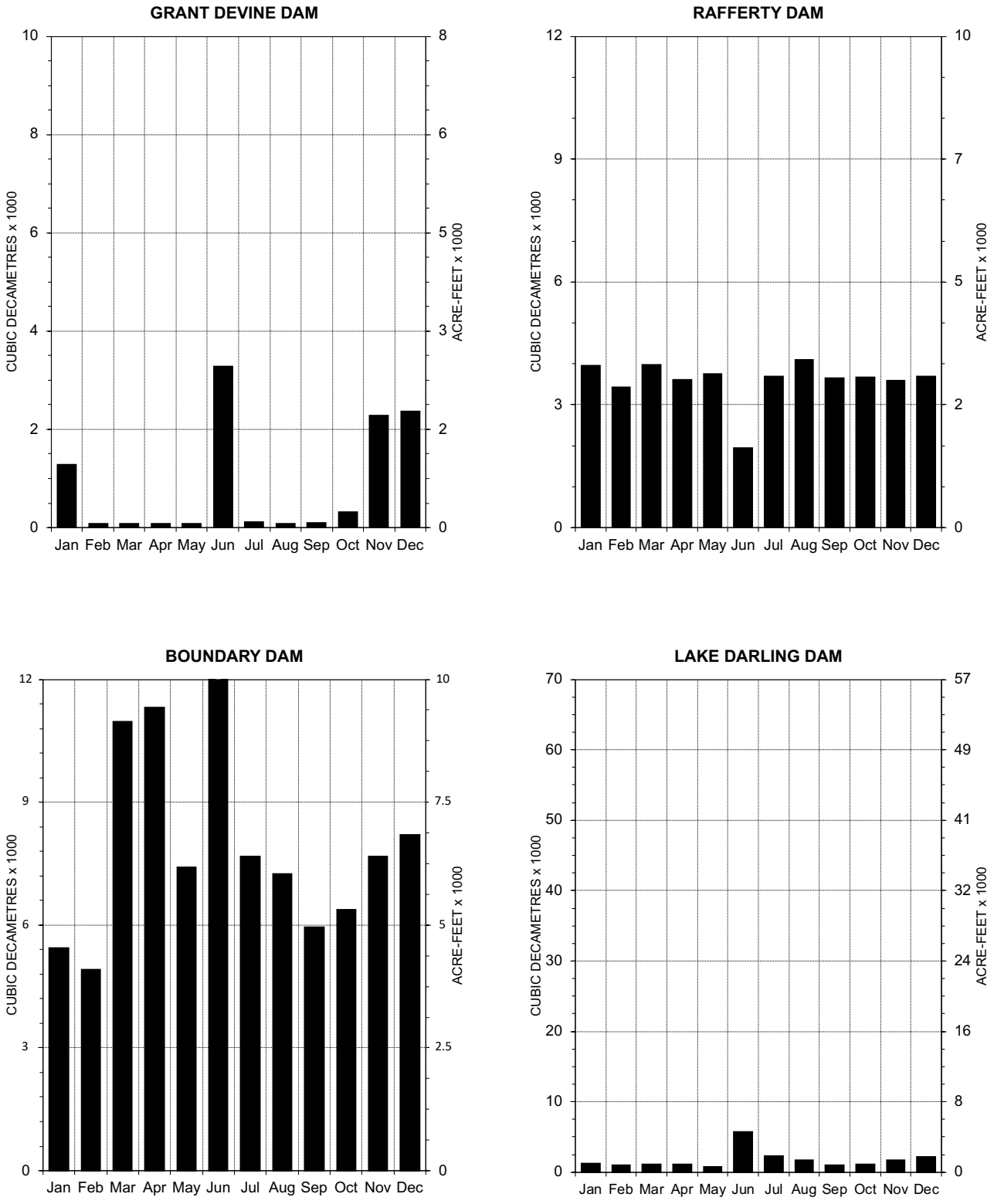
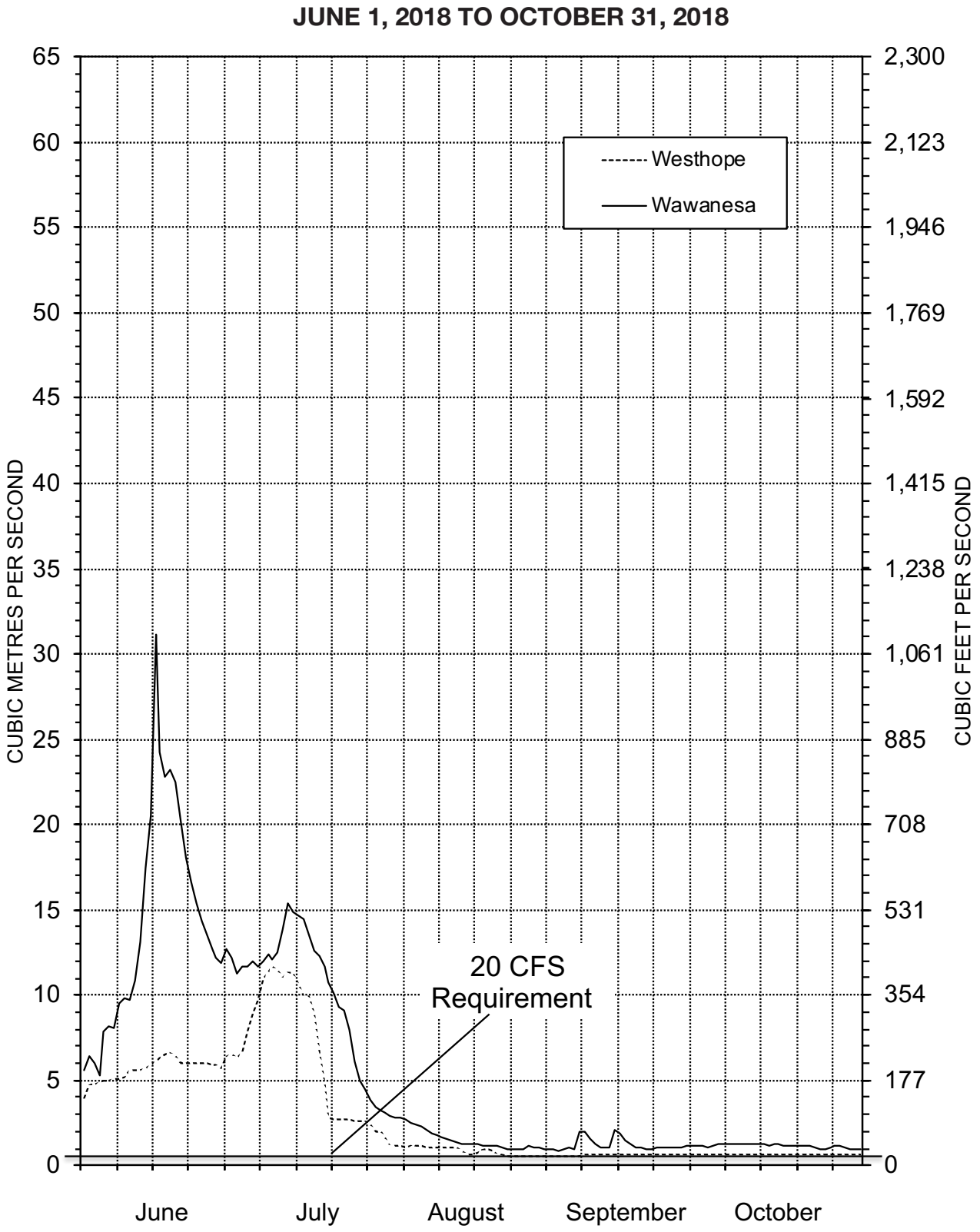
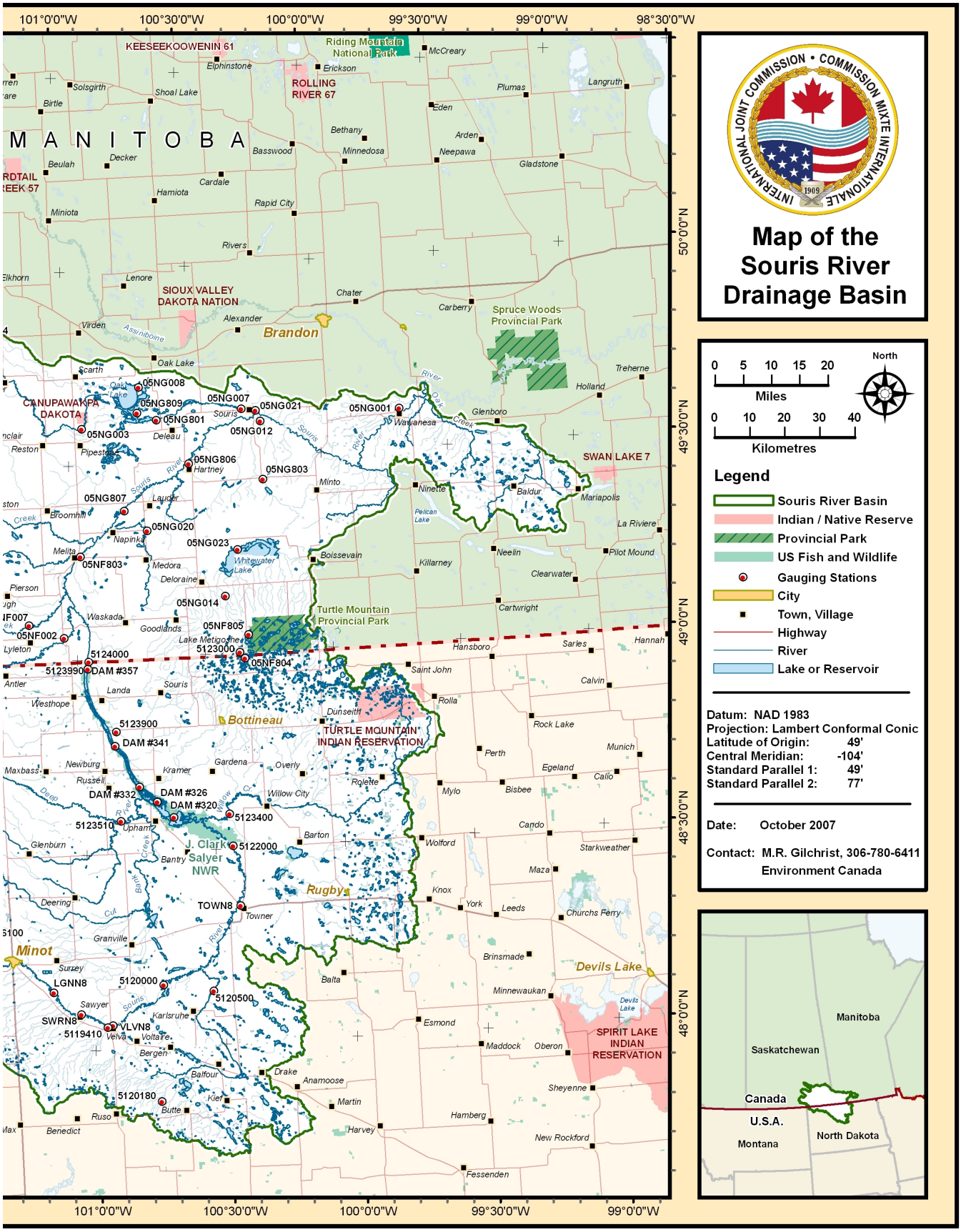


**Figure 5.** Souris River near Westhope and Wawanesa.




SASKATCHEWAN
MONTANA
NORTH DAKOTA
Regina
Estevan
Weyburn
Moose Mountain Provincial Park
SAKIMAY I.R. 74
COWESSESS I.R. 73
KAHKEWISTAHAW I.R. 72
OCHAPOWACE I.R. 71
ASSINIBOINE I.R. 76
PIAPOT I.R. 75
OCEAN MAN I.R. 69
PHEASANT RUMP NAKOTA BAND I.R. 68
WHITE BEAR I.R. 70
FORT PECK INDIAN RESERVATION
FORT BERTHOLD INDIAN RESERVATION
Des Lacs NWR
Upper Souris NWR
Lostwood NWR
Williston
Sidney
Lake Sakakawea
105°0'0"W
104°30'0"W
104°0'0"W
103°30'0"W
103°0'0"W
102°30'0"W
102°0'0"W
101°30'0"W
50°30'0"N
50°0'0"N
49°30'0"N
49°0'0"N
48°30'0"N
48°0'0"N


Map of the Souris River Drainage Basin
INTERNATIONAL JOINT COMMISSION • COMMISSION MIXTE INTERNATIONALE
1909
MANITOBA
KEESEEKOOWENIN 61
ROLLING RIVER 67
SIOUX VALLEY DAKOTA NATION
CANUPAWAKPA DAKOTA
Riding Mountain National Park
Spruce Woods Provincial Park
Turtle Mountain Provincial Park
TURTLE MOUNTAIN INDIAN RESERVATION
SPIRIT LAKE INDIAN RESERVATION
SWAN LAKE 7
J. Clark Salyer NWR
Brandon
Minot
Bottineau
Rugby
Devils Lake
101°0'0"W
100°30'0"W
100°0'0"W
99°30'0"W
99°0'0"W
98°30'0"W
50°0'0"N
49°30'0"N
49°0'0"N
48°30'0"N
48°0'0"N
0 5 10 15 20
Miles
0 10 20 30 40
Kilometres
North
Legend
Souris River Basin
Indian / Native Reserve
Provincial Park
US Fish and Wildlife
Gauging Stations
City
Town, Village
Highway
River
Lake or Reservoir
Datum: NAD 1983
Projection: Lambert Conformal Conic
Latitude of Origin: 49'
Central Meridian: -104'
Standard Parallel 1: 49'
Standard Parallel 2: 77'
Date: October 2007
Contact: M.R. Gilchrist, 306-780-6411
Environment Canada
Manitoba
Saskatchewan
Canada
U.S.A.
Montana
North Dakota

# APPENDIX A

# Determination of Natural Flow of Souris River at International Boundary (Sherwood)

# DETERMINATION OF NATURAL FLOW OF SOURIS RIVER AT INTERNATIONAL BOUNDARY (SHERWOOD)

**All Quantities Reported In Cubic Decametres**

**FOR THE PERIOD: JANUARY 1 TO DECEMBER 31, 2018**

## LONG CREEK BASIN

| LARSEN RESERVOIR | | | | BOUNDARY RESERVOIR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | INFLOW | OUTFLOW | | | | | | | |
| 1 | 2 | 3 | 4 | 5 * | 6 | 7 | 8 | 9 | 10 | 11 | 12 * | 13 |
| STORAGE CHANGE | EVAPORATION & SEEPAGE | DIVERSION | TOWN OF RADVILLE PUMPAGE | LONG CREEK AT EASTERN CROSSING | LONG CREEK NEAR ESTEVAN | ESTEVAN PIPELINE | DIVERSION CANAL | TOTAL (OUTFLOW) | DIVERSION | MINOR PROJECT DIVERSION | U.S.A. DIVERSION BETWEEN WESTERN & EASTERN CROSSING | **TOTAL DIVERSION LONG CREEK** |
| -98 | 122 | 24 (1+2) | 0 | 6952<br>0<br>PIPELINE | 100 | 2344 | 0 | 2444 (6+7+8) | 4508 (5-9) | 803 | 995 | 6330 **(3+4+10+11+12)** |

## UPPER SOURIS RIVER BASIN - ABOVE ESTEVAN

| NICKLE LAKE RESERVOIR | | | | | ROUGHBARK RESERVOIR | | | RAFFERTY RESERVOIR | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| STORAGE CHANGE | EVAPORATION & SEEPAGE | CITY OF WEYBURN PUMPAGE | DIVERSION | CITY OF WEYBURN RETURN FLOW | STORAGE CHANGE | EVAPORATION & SEEPAGE | DIVERSION | INFLOW | OUTFLOW | DIVERSION | MINOR PROJECT DIVERSION | **TOTAL DIVERSION UPPER SOURIS RIVER** |
| 1900 | 2159 | 1699 | 5758 (14+15+16) | 933 | -672 | 232 | -440 (19+20) | 4368 | 2730<br>0<br>PIPELINE | 1638 (22-23) | 1391 | 7414 **(17-18+21+24+25)** |

## LOWER SOURIS RIVER--ESTEVAN TO SHERWOOD

| 27 | 28 * | 29 | 30 |
|---|---|---|---|
| CITY OF ESTEVAN NET PUMPAGE | SHORT CREEK DIVERSIONS IN U.S.A. | MINOR PROJECT DIVERSION | **TOTAL DIVERSION LOWER SOURIS RIVER** |
| 1794 | 1638 | 1575 | 5007 **(27+28+29)** |

## MOOSE MOUNTAIN CREEK BASIN

| MOOSE MOUNTAIN LAKE | | | GRANT DEVINE LAKE | | | | |
|---|---|---|---|---|---|---|---|
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |
| STORAGE CHANGE | EVAPORATION & SEEPAGE | DIVERSION | STORAGE CHANGE | EVAPORATION & SEEPAGE | DIVERSION | MINOR PROJECT DIVERSIONS | **TOTAL DIVERSIONS MOOSE MOUNTAIN CREEK BASIN** |
| -390 | 1306 | 916 (31+32) | 300 | 4772 | 5072 (34+35) | 1411 | 7399 **(33+36+37)** |

## NON-CONTRIBUTORY BASINS

| 39 | 40 | 41 |
|---|---|---|
| YELLOW GRASS DITCH | TATAGWA LAKE DRAIN | **TOTAL ADDITIONS** |
| 3441 | 18 | 3459 (39+40) |

*** DATA CONTRIBUTED BY U.S.G.S.**

## SUMMARY OF NATURAL FLOW

| 42 | 43 * | 44 | 45 | 46 | 47 |
|---|---|---|---|---|---|
| TOTAL DIVERSION SOURIS RIVER BASIN | RECORDED FLOW AT SHERWOOD | NATURAL FLOW AT SHERWOOD | U..S.A. SHARE | FLOW RECEIVED BY U.S.A. | **SURPLUS (+) OR DEFICIT (-) TO U.S.A.** |
| | | | 40% OF 44<br>22170 | | (46-45) 40% SHARE<br>**13194** |
| 26150 (13+26+30+38) | 32731 | 55422 (42+43-41) | 50% OF 44 | 35364 (12+28+43) | (46-45) 50% SHARE |

## RECOMMENDATION - SECTION 2
## ANNUAL FLOW OF LONG CREEK

| 48 | 49 * | 50 |
|---|---|---|
| RECORDED FLOW AT WESTERN CROSSING | RECORDED FLOW AT EASTERN CROSSING | **SURPLUS (+) OR DEFICIT (-) FROM U.S.A.** |
| 5006 | 6952 | **1946** (49-48) |

# APPENDIX B

# Equivalents of Measure

## EQUIVALENTS OF MEASUREMENTS

The following is a list of equivalents of measurement that have been agreed to for use in reports of the International Souris River Board.

1 centimetre equals 0.39370 inch
1 metre equals 3.2808 feet
1 kilometre equals 0.62137 mile

1 hectare equals 10 000 square metres
1 hectare equals 2.4710 acres
1 square kilometre equals 0.38610 square mile

1 cubic metre per second equals 35.315 cubic feet per second

The metric (SI) unit that replaces the British acre-foot unit is the cubic decametre (dam3), which is the volume contained in a cube 10 m x 10 m x 10 m or 1 000 cubic metres.

1 cubic decametre equals 0.81070 acre-feet
1 cubic metre per second flowing for 1 day equals 86.4 cubic decametres
1 cubic foot per second flowing for 1 day equals 1.9835 acre-feet

# APPENDIX C

# Interim Measures as Modified in 2000

## INTERIM MEASURES AS MODIFIED IN 2000

## APPENDIX A TO THE DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

1. The Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the Sherwood Crossing more than 50 percent of that which would have occurred in a state of nature, as calculated by the International Souris River Board. For the purpose of these calculations, any reference to "annual" and "year" is intended to mean the period January 1 through December 31.

   For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, so far as is practicable, regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metre per second (4 cubic feet per second) when that much flow would have occurred under the conditions of water use development prevailing in the Saskatchewan portion of the Souris River basin prior to construction of the Boundary Dam, Rafferty Dam, and Alameda Dam.

   Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the annual natural flow volume at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control in North Dakota and of evaporation as a result of the project.

   a. Saskatchewan will deliver a minimum of 50 percent of the annual natural flow volume at the Sherwood Crossing in every year except in those years when the conditions given in (i) or (ii) below apply. In those years, Saskatchewan will deliver a minimum of 40 percent of the annual natural flow volume at the Sherwood Crossing.

      i. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 486.095 metres (1594.8 feet); or

      ii. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 485.79 metres (1593.8 feet), and since the last occurrence of a Lake Darling June 1 elevation of greater than 486.095 metres (1594.8 feet) the elevation of Lake Darling has not been less than 485.79 metres (1593.8 feet) on June 1.

b. Notwithstanding the annual division of flows that is described in (a), in each year Saskatchewan will, so far as is practicable as determined by the Board, deliver to North Dakota prior to June 1, 50 percent of the first 50 000 cubic decametres (40,500 acre-feet) of natural flow which occurs during the period January 1 to May 31. The intent of this division of flow is to ensure that North Dakota receives 50 percent of the rate and volume of flow that would have occurred in a state of nature to try to meet existing senior water rights.

c. Lake Darling Reservoir and the Canadian reservoirs will be operated (insofar as is compatible with the Projects' purposes and consistent with past practices) to ensure that the pool elevations, which determine conditions for sharing evaporation losses, are not artificially altered. The triggering elevation of 485.79 metres (1593.8 feet) for Lake Darling Reservoir is based on existing water uses in North Dakota, including refuges operated by the U.S. Fish and Wildlife Service. Each year, operating plans for the refuges on the Souris River will be presented to the Board. Barring unforeseen circumstances, operations will follow said plans during each given year. Lake Darling Reservoir will not be drawn down for the sole purpose of reaching the elevation of 485.79 metres (1593.8 feet) on June 1. Releases will not be made by Saskatchewan Watershed Authority from the Canadian reservoirs for the sole purpose of raising the elevation of Lake Darling Reservoir above 486.095 metres (1594.8 feet) on June 1.

d. Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow.

e. A determination of the annual apportionment balance shall be made by the Board on or about October 1 of each year. Any shortfall that exists as of that date shall be delivered by Saskatchewan prior to December 31.

f. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the 0.113 cubic metre per second (4 cubic feet per second) minimum flow limit, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. Prior to these releases being made, consultations shall occur between the Saskatchewan Watershed Authority, the U.S. Fish and Wildlife Service, and the State of North Dakota. All releases will be within the specified target flows at the control points.

2. Except as otherwise provided herein with respect to delivery of water to the Province of Manitoba, the State of North Dakota shall have the right to divert, store, and use the waters which originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing under Recommendation (1) above; provided, that any diversion, use, or storage of Long Creek water shall not diminish the annual flow at the eastern crossing of Long Creek into Saskatchewan below the annual flow of said Creek at the western crossing into North Dakota.

3. In addition to the waters of the Souris River basin which originate in the Province of Manitoba, that Province shall have the right, except during periods of severe drought, to receive for its own use and the State of North Dakota shall deliver from any available source during the months of June, July, August, September, and October of each year, six thousand and sixty-nine (6,069) acre-feet of water at the Westhope Crossing regulated so far as practicable at the rate of twenty (20) cubic feet per second except as set forth hereinafter: provided, that in delivering such water to Manitoba no account shall be taken of water crossing the boundary at a rate in excess of the said 20 cubic feet per second.

   In periods of severe drought when it becomes impracticable for the State of North Dakota to provide the foregoing regulated flows, the responsibility of the State of North Dakota in this connection shall be limited to the provision of such flows as may be practicable, in the opinion of the said Board of Control, in accordance with the objective of making water available for human and livestock consumption and for household use. It is understood that in the circumstances contemplated in this paragraph the State of North Dakota will give the earliest possible advice to the International Souris River Board of Control with respect to the onset of severe drought conditions.

4. In event of disagreement between the two sections of the International Souris River Board of Control, the matters in controversy shall be referred to the Commission for decision.

5. The interim measures for which provision is herein made shall remain in effect until the adoption of permanent measures in accordance with the requirements of questions (1) and (2) of the Reference of January 15, 1940, unless before that time these interim measures are qualified or modified by the Commission.

# APPENDIX D

# Board Directive from January 18, 2007

## DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

The International Souris River Board was created by the International Joint Commission in April 2000 when it amalgamated the Souris River basin responsibilities previously assigned to the Commission in two separate references by the governments of Canada and the United States. The two references were the International Souris River Board of Control Reference (1959) and the Souris-Red River Engineering Board Reference (1948). The International Souris River Board's mandate changed further through an exchange of diplomatic notes on June 9, 2005 assigning water quality functions and the oversight for flood forecasting and operations as described in Section 4 below. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the International Souris River Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

The directive replaces the April 11, 2002 Directive to the International Souris River Board and sets out the mandate under which the Board will operate.

1. Pursuant to the Boundary Water Treaty of 1909 and related agreements, responsibilities have been conferred on the Commission to ensure compliance with apportionment measures for the waters of the Souris River, to investigate and report on water requirements and uses as they impact the transboundary waters of the Souris River basin, and to assist in the implementation and review of the Joint Water Quality Monitoring Program pursuant to the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.

2. The apportionment measures derive from the approvals given by the governments of Canada and the United States, by letters of March 20, 1959 and April 3, 1959 respectively, to the recommendations made by the Commission in paragraph 22 of its report to the governments of March 19, 1958. Subsequently, with the signing of the Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin on October 26, 1989 (hereafter referred to as the 1989 Agreement), the Interim Measures for apportionment of the Souris River at the Saskatchewan-North Dakota boundary were revised as described in Annex B of the 1989 Agreement. By letters of measures as modified in the 1989 Agreement. By letters of December 20 and 22, 2000, the governments amended Annex B of the 1989 Agreement. The attached Appendix A is a consolidation of the apportionment measures against which the Commission is to monitor compliance.

3. By letters of January 12, 1948, the governments requested the Commission to undertake investigations of water requirements and uses arising out of existing dams and other works or projects in the mid-continent portion of the Canada-United States boundary, including the Souris River basin, and to make advisory recommendations.

4. By exchange of diplomatic notes between the governments of Canada and the United States dated January 14 and June 9, 2005, the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin was formally revised to

include a reference pursuant to Article IX of the Boundary Waters Treaty which assigned water quality responsibilities contained in the 1989 Agreement to the Commission. The Commission was requested to assist with the implementation and review of the Joint Water Quality Monitoring Program. On October 21, 2005 at the October 2005 Commission's meeting with governments, the U.S. State Department is of the opinion the Commission has the authority and has obtained the notification it needs from the U.S. State Department to proceed with carrying out the flood related responsibilities for the Souris River. On April 6, 2006 at the April 2006 Commission's meeting with the governments, the Department of Foreign Affairs and International Trade indicated that the Board should be assigned these responsibilities. It is recognized that Article X of the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin designated the entities responsible for operation and maintenance of the improvements mentioned in the 1989 Agreement and that the operations will be in accordance with the Operating Plan shown in Annex A of the 1989 Agreement. The Department of Army is the entity responsible for flood operations within the Canadian Province of Saskatchewan.

5. The Board's mandate is to support the Commission's initiative to explore and encourage the development of local and regional capacity with the objective of preventing and resolving transboundary disputes regarding the waters and aquatic ecosystem of the Souris River and its tributaries and aquifers. This would be accomplished through the application of best available science and knowledge of the aquatic ecosystem of the basin and an awareness of the needs, expectations and capabilities of residents of the Souris River basin. The Board's mandate will be accomplished by performing the tasks identified in Clause 6 below.

6. The Board's duties shall be to:

    i. Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.

    ii. Oversee the implementation of compliance with the Interim Measures As Modified For Apportionment of the Souris River as described in Appendix A of this document by:

        - Identifying an adequate hydro-climatic monitoring network to support the determination of natural flow and apportionment balance,

        - Encouraging the appropriate authorities to establish and maintain hydroclimatic monitoring and information collection networks and reporting systems to ensure suitable information is available as required for the determination of natural flow and apportionment balance,

- Informing the Commission, in a timely manner, of critical water supply or flow conditions in the basin,

- Encouraging appropriate authorities to take steps to ensure that apportionment measures are met, and

- Preparing an annual report and submitting it to the Commission.

iii. Assist the Commission in the review of a Joint Water Quality Monitoring Program (referred to hereafter as "the Program") by:

- Developing recommendations on the Program and the setting of water quality objectives,
- Exchanging data provided by the Program on a regular basis,
- Collating, interpreting, and analyzing the data provided by the Program,
- Reviewing the Program and the water quality objectives at least every five years and developing recommendations, as appropriate, to the Commission to improve the Program and the objectives, and
- Preparing an annual report containing:

  - A summary of the principal activies of the Board during the year with respect to the Program,
  - A summary of the principal activities affecting water quality in the Souris River Basin during the year,
  - A summary of the collated, interpreted, and analyzed data provided by the Program,
  - A summary of the water quality of the Souris River at the two locations at which it crosses the International Boundary,
  - A section summarizing any definitive changes in the monitored parameters and the possible causes of such changes,
  - A section discussing the water quality objectives for the Souris River at the Saskatchewan/ North Dakota boundary and at the North Dakota/Manitoba boundary as established and revised pursuant to the 1989 Agreement,
  - A section summarizing other significant water quality changes and the possible causes of such changes, and
  - Recommendations on new water quality objectives or on how existing water quality objectives can be met, including suggestions on water quality as it relates to water quantity during periods of low flow, in the event that the annual report indicates that the water quality objectives have not been attained as a result of activities pursued under the 1989 Agreement.

iv. Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin by:

- Ensuring mechanisms are in place for coordination of data exchange, flood forecasts and communications related to flood conditions and operations;
- Determining whether the operations under the 1989 Agreement should proceed based on the Flood Operation of Non-Flood Operation of the Operating Plan, which is Annex A to the 1989 Agreement, using its criteria and informing designated agencies of this determination;
- Reporting to the Commission on any issues related to flood operations and management; and
- Providing the Commission and the designated entities under the 1989 Agreement recommendations on how flood operations and coordination activities could be improved.

v. Report on aquatic ecosystem health issues in the watershed, regularly informing the Commission on the state and implications of aquatic ecosystem health, and encourage the appropriative authorities to establish and maintain water quality and other monitoring and information collection networks and reporting systems to ensure suitable information is available as required for the determination of the health of the aquatic ecosystem.

vi. Carry out such other studies or activities as the Commission ma, from time to time, request.

vii. Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year. The work plan shall be submitted annually to IJC for review.

7. The Board shall provide opportunities for the public to be involved in its work, including at least on public meeting in the basin each year.

8. The Board shall coordinate and collaborate with other agencies and institutions both within and outside the Souris River basin as may be needed or desirable, and facilitate the timely dissemination of pertinent information within the basin. The Board shall keep the Commission informed of these activities.

9. The Board shall have an equal number of members from each country. The Commission shall normally appoint each member for a three-year term. Appointments may be renewed for additional terms. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. The Commission shall appoint Canadian and United States co-chairs for the Board and will strive to appoint chairs with complementary expertise that encompasses a broad spectrum of basin issues.

10. The co-chairs of the Board shall be responsible for maintaining proper liaison between the Board and the Commission, and amount the Board members.

11. The co-chairs shall ensure that members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

12. The co-chairs may appoint secretaries of the Board who, under the general supervision of the co-chairs, shall carry out such duties as are assigned by the co-chairs or the Board as a whole.

13. The Board may establish such committees and working groups as may be required to fulfill its responsibilities in a knowledgeable and effective manner. The Commission shall be kept informed of the duties and composition of any committee or working group.

14. Unless other arrangements are made with the Commission, members of the Board, committees, or working groups shall make their own arrangements for reimbursement of necessary expenditures for travel or other related expenses.

15. The Board shall inform the Commission in advance of plans for any meetings or other means of involving the public in Board deliberations, and shall report to the Commission, in a timely manner, on these and any other presentations or representations made to the Board.

16. The Board shall conduct its public outreach activities in accordance with the Commission's public information policies and shall maintain files in accordance with the Commission policy on segregation of documents.

17. Prior to their release, the Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers.

18. The Board shall submit an annual report covering all of its activities, including the annual report regarding the Program and the work plan, as described in Section 6 above, to the Commission, at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive. Reports shall be submitted in a format suitable for public release and electronic copies shall be provided to each of the Commission's section offices.

19. Reports, including annual reports, minutes and correspondence of the Board shall, normally, remain privileged and be available only to the Commission and to members of the Board and its committees until their release has been authorized by Commission. The Board shall provide minutes of Board meetings to the Commission within 45 days of the close of the meeting in keeping with the Commission's April 2002 Policy Concerning Public Access to Minutes of Meetings. The minutes will subsequently be put on the Commission's website.

20. If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, the matter shall be referred promptly to the Commission for appropriate action.

21. The Board shall operate by consensus. In the event of any disagreement among the members of the Board which they are unable to resolve, the Board shall refer the matter forthwith to the Commission for decision.

22. The Commission may amend existing instructions or issue new instructions to the Board at any time.

Signed this 18th day of January, 2007

Elizabeth Bourget
Secretary
United States Section

Murray Clamen
Secretary
Canadian Section

# APPENDIX E

# Water Quality Data for Sherwood and Westhope

2018 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - SASKATCHEWAN/NORTH DAKOTA BOUNDARY
05114000 SHERWOOD USGS

| WATER QUALITY PARAMETER | WATER QUALITY OBJECTIVE | UNITS | HISTORIC DATA* Median (max - min) #samples | HISTORIC DATA % detectable | HISTORIC DATA % exceedance | ANNUAL DATA 2018 Median (max - min) #samples | 2018 DATA % detectable | 2018 % exceedance |
|---|---|---|---|---|---|---|---|---|
| **Biological Parameters** | | | | | | | | |
| Fecal Coliform | 200/100 ml | #/100 ml | 7 (1900 - <2) 204 | 60.8 | 4 | NS | | |
| E. coli [a] | (400/100 ml)[c] | #/100 ml | 80 (600 - <10) 51 | 58.6 | 3 | 190 (230 - 97) 4 | 100 | 0 |
| **Inorganic Parameters** | | | | | | | | |
| Ammonia (un-ionized as N) | *** | mg/L | 0.04 (3.3 – 0.01) 198 | calculated | - | 0.07 (1.9 – 0.55) 7 | calculated | - |
| Chloride | 100 | mg/L | 34.2 (220 – 4.0) 213 | 100 | 8 | 25.8 (58.3 - 10.8) 7 | 100 | 0 |
| Fluoride | 1.5 | mg/L | 0.20 (1.8 - <0.17) 213 | 93.4 | 0.5 | 0.20 (0.23 - 0.11) 7 | 100 | 0 |
| $NO_2 + NO_3$ (as N) dissolved | 1.0 | mg/L | 0.06 (1.4 - <0.02) 202 | 70.2 | 0.9 | <0.02 (0.263 - <0.02) 7 | 14 | 0 |
| Phosphorus (total P) | 0.10 | mg/L | 0.22 (1.9 - 0.03) 214 | 100 | 88 | 0.25 (0.39 - 0.13) | 100 | 100 |
| Sodium | 100 | mg/L | 128 (532 - 14) 212 | 100 | 65 | 132 (254 – 59.7) 7 | 100 | 85.7 |
| Sulfate | 450 | mg/L | 273 (1000 - 48) 213 | 100 | 15 | 328 (556 - 160) 7 | 100 | 28.6 |
| | | | | | | | | |
| Arsenic (total) | 50 | µg/L | 4 (28.3 -< 2) 205 | 95.8 | 0 | 7.3 (17 - 2.1) 7 | 100 | 0 |
| Barium (total) | 1,000 | µg/L | 91.9 (200 - 14) 205 | 82.3 | 0 | 68.2 (78.8 – 34.9) 7 | 100 | 0 |
| Boron (total) | 500 | µg/L | 183 (3500 - 40) 203 | 100 | 7 | 186 (267 - 67) 7 | 100 | 0 |
| Beryllium (total) | 100 | µg/L | 0.09 (43.5 - <0.01) 205 | 53.2 | 0 | 0.01 (0.07 - <0.01) 7 | 85.7 | 0 |
| Cadmium (total) | **27 | µg/L | 0.06 (1.0 - <0.01) 205 | 60.1 | 0 | 0.04 (0.07 - 0.03) 7 | 100 | 0 |
| Chromium (total) | 50 | µg/L | 0.50 (3.5 - 0.1) 204 | 66.6 | 0 | 0.60 (1.7 - 0.25) 7 | 71.4 | 0 |
| Cobalt (total) | 50 | µg/L | 0.8 (2.2 - 0.23) 205 | 77.1 | 0 | 0.66 (1.29 - 0.31) 7 | 100 | 0 |
| Copper (total) | **30 | µg/L | 2.4 (18.6 - 0.8) 204 | 91.8 | 0 | 2.1 (3.5 - 1.4) 7 | 100 | 0 |
| Iron (total) | 300 | µg/L | 600 (5870 – 8) 204 | 99.6 | 76 | 530 (2120 - 168) 7 | 100 | 85.7 |

* in historic dataset, values below detection limits (<) are included at ½ detection limit for median calculations; historic dataset is from 1991 - 2016 unless otherwise indicated

[a] E. coli sampling started in 2008, [c]

**value shown is based on hardness of 300 mg/L, actual objective is a hardness-based equation ***un-ionized ammonia is calculated using temperature and pH, % detectable not applicable

2018 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - SASKATCHEWAN/NORTH DAKOTA BOUNDARY
05114000 SHERWOOD USGS

| WATER QUALITY PARAMETER | WATER QUALITY OBJECTIVE | UNITS | HISTORIC DATA* Median (max - min) #samples | HISTORIC DATA % detectable | HISTORIC DATA % exceedance | ANNUAL DATA 2018 Median (max - min) #samples | 2018 DATA % detectable | 2018 %exceedance |
|---|---|---|---|---|---|---|---|---|
| Lead (total) | **13 | µg/L | 1.0 (4.54 - 0.09) 205 | 81.1 | 0 | 0.32 (1.42-0.09) 7 | 100 | 0 |
| Mercury | 0.5 ug/g in fish flesh | µg/g | NS | NS | NS | NS | NS | |
| Molybdenum (total) | 10 | µg/L | 3.0 (45.0 - 0.48) 205 | 97 | 5 | 2.88 (5.96 – 1.73) 7 | 100 | 0 |
| Nickel (total) | **220 | µg/L | 4.0 (11.7 – 1.7) 209 | 100 | 0 | 4.4 (6.0 - 2.5) 7 | 100 | 0 |
| Selenium (total) | 5 | µg/L | 1.0 (1.4 - <0.4) 205 | 97.9 | 0.5 | 0.5 (0.7 - 0.4) 7 | 100 | 0 |
| Zinc (total) | 30 | µg/L | 6.15 (11.0 -<2.0) 140 | 72.4 | 0 | 4.0 (9.0 - 1.0) 7 | 71.4 | 0 |
| | | | | | | | | |
| **Miscellaneous** | | | | | | | | |
| | | | | | | | | |
| Total Dissolved Solids | 1,000 | mg/L | 813 (1890 - 304) 95 | calculated | 27 | 870 (1260 - 380) 7 | calculated | 28.6 |
| Total Suspended Solids | the lesser of 10 mg/L or 10% over ambient | mg/L | 19 (256 - <1) 205 | 70.3 | 67.3 | 19 (78 – 7.5) 7 | 71.4 | 38 |
| pH (range) | 8.5-6.5 | standard units | 8.2 (9.2 – 6.9) 252 | 100 | 13.9 | 8.0 (8.6 - 7.6) 7 | 100 | 38 |
| Dissolved Oxygen (conc.) | >5.0 | mg/L | 8.6 (19.4 - 0.3) 214 | 100 | 12.5 | 8.5 (11.9 – 6.4) 7 | 100 | 0 |
| Aesthetics | | visual | NS | | | NS | | |
| Oil and Grease | | visual | NS | | | NS | | |
| | | | | | | | | |

* in historic dataset, values below detection limits (<) are calculated at ½ detection limit; dataset is from 1991 - 2016 unless otherwise indicated
**value shown is based on hardness of 300 mg/L, actual objective is a hardness-based equation
NS: Not Sampled
calculated: parameter: calculated from other measured values, % detectable not applicable

2018 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - SASKATCHEWAN/NORTH DAKOTA BOUNDARY
05114000 SHERWOOD USGS

| WATER QUALITY PARAMETER | WATER QUALITY OBJECTIVE | UNITS | HISTORIC DATA** Median (max-min) # samples | HISTORIC DATA % detectable | HISTORIC DATA % exceedance | ANNUAL DATA 2018 Median (max-min) # samples | 2018 DATA % detectable | 2018 %exceedance |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **Organic Parameters** | | | | | | | | |
| Atrazine | 2 | µg/L | 0.0160 (0.0464 - <0.0019) 71 | 66.2 | 0 | 0.0182 (0.0223 - 0.0130) 6 | 100 | 0 |
| Bromoxynil | 5 | µg/L | <0.0081 (0.2020 - <0.0002) 97 | 28 | 0 | 0.0005 (0.0054 - <0.0002) 6 | 50 | 0 |
| Carbaryl | 90 | µg/L | NS | | | NS | | |
| a-Chlordane | 0.0043 | µg/L | <0.0001 (<0.0001 - <0.0001) 94 | 0 | 0 | (< DL 0.00048) 6 | 0 | 0 |
| g-Chlordane | 0.0043 | µg/L | <0.0001 (0.0011 - <0.0001) 94 | 1.1 | 0 | (< DL 0.00041) 6 | 0 | 0 |
| DDT | 0.001 | µg/L | <0.0004 (0.0027 - <0.0004) 94 | 1.1 | 1 | (< DL 0.00180) 6 | 0 | 0 |
| Dieldrin | 0.0019 | µg/L | <0.0003 (0.0003 - <0.0003) 94 | 1.1 | 0 | (< DL 0.00133) 6 | 0 | 0 |
| Dicamba | In development | µg/L | 0.0097 (0.0451 - <0.0004) 97 | 48.5 | - | 0.0002 (0.0348 - < 0.0004) 6 | 33.3 | - |
| Diclofop-methyl | In development | µg/L | <0.0074 (<0.0074-<0.0074) 95 | 0 | - | (< DL 0.01160) 6 | 0 | - |
| Heptachlor | 0.0038 | µg/L | <0.0001(<0.0001 -<0.0001) 89 | 0 | 0 | NS | NS | |
| MCPA | 0.20 | µg/L | 0.0150 (0.3150 - <0.0006) 97 | 53.6 | 4 | 0.0058 (0.0330 - 0.0021) 6 | 100 | 0 |
| Parathion | 0.04 | µg/L | <0.0155 (<0.0155 - <0.0155) 33 | 0 | 0 | NS | NS | |
| Phenols (total) | 1.0 | µg/L | NS | | | NS | NS | |
| Picloram | 0.05 | µg/L | 0.0250 (0.1700 - <0.0007) 97 | 35.1 | 10 | 0.0051 (0.1320 - <0.0006) 6 | 66.7 | 33 |
| Polychlorinated biphenyl (PCB total) | 0.001 | µg/L | <0.0002 (<0.0002-<0.0002) 43 | 0 | 0 | NS | NS | |
| Triallate | 0.57 | µg/L | <0.0022 (0.0800 - <0.0022) 95 | 6.3 | 0 | (< DL 0.00441) 6 | 0 | 0 |
| Trifluralin | 0.10 | µg/L | <0.0026 (<0.0026 - <0.0026) 95 | 0 | 0 | (< DL 0.00263) 6 | 0 | 0 |
| 2,4-D | 4.0 | µg/L | 0.0445 (0.5870 - < 0.0005) 97 | 76.3 | 0 | 0.0431 (0.1770 - 0.0302) 6 | 100 | 0 |
| | | | | | | | | |

** For Pesticides, historic data values below detection limits (<) are calculated at ½ detection limit; dataset is from 1991 - 2016 unless otherwise indicated. There are frequently multiple detection limits within the date range. The maximum for parameters with only one detection over the period of record (DDT, Dieldrin, Gamma Chlordane) is given as the value of the single detection, although detection limits higher than that value may have occurred. The median is given as the median of all detection limits.
NS: Not Sampled

2018 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY
US05NF0001 WESTHOPE

| WATER QUALITY PARAMETER | WATER QUALITY OBJECTIVE | UNITS | HISTORIC DATA* Median (max - min) #samples | HISTORIC DATA % detectable | HISTORIC DATA % exceedance | ANNUAL DATA 2018 Median (max - min) #samples | 2018 DATA % detectable | 2018 % exceedance |
|---|---|---|---|---|---|---|---|---|
| **Biological Parameters** | | | | | | | | |
| Fecal Coliform | 200/100 ml | #/100 ml | 7 (1900 - <2) 211 | 60.7 | 4.3 | 22 (190 - <2) 8 | 62.5 | 0 |
| E. coli [a] | 400/100 ml[a] | #/100 ml | 5 (2800 - <2) 78 | 59.0 | 3.8 | *19.9*[a] (140 - <2) 8 | 62.5 | Neither [a] exceeded |
| **Inorganic Parameters** | | | | | | | | |
| Ammonia (un-ionized as N) | *** | mg/L | 0.005 (0.425 – 0.0) 207 | calculated | - | 0.012 (0.046 – 0.002) 8 | calculated | - |
| Chloride | 100 | mg/L | 34.4 (297 - 6.2) 214 | 100 | 3.7 | 39.7 (163 - 30.1) 8 | 100 | 25 |
| Fluoride | 1.5 | mg/L | 0.19 (0.87 - <0.01) 213 | 99.5 | 0 | 0.16 (0.32 - 0.12) 8 | 100 | 0 |
| $NO_2$ + $NO_3$ (as N) dissolved | 1.0 | mg/L | <0.01 (1.11 - <0.01) 213 | 51.6 | 0.5 | 0.03 (0.24 - <0.01) 8 | 87.5 | 0 |
| Phosphorus (total P) | 0.10 | mg/L | 0.305 (4.52 - 0.091) 212 | 100 | 99.1 | 0.315 (1.070 - 0.251) 8 | 100 | 100 |
| Sodium | 100 | mg/L | 153 (1040 - 19) 214 | 100 | 80 | 162 (693 - 115) 8 | 100 | 100 |
| Sulfate | 450 | mg/L | 300 (3490 - 38) 214 | 100 | 22 | 458 (1880 - 326) 8 | 100 | 50 |
| | | | | | | | | |
| Arsenic (total) | 50 | µg/L | 4.6 (33.4 - 0.6) 195 | 100 | 0 | 9.1 (11.1 - 5.0) 8 | 100 | 0 |
| Barium (total) | 1,000 | µg/L | 87.0 (631 - 32.3) 213 | 97.6 | 0 | 89.5 (427 – 67.3) 8 | 100 | 0 |
| Boron (total) | 500 | µg/L | 197 (2080 - 41) 181 | 99.4 | 2.2 | 203 (532 - 146) 8 | 100 | 13 |
| Beryllium (total) [b] | 100 | µg/L | 0.016 (0.139 - <0.001) 117 [b] | 99.2 [b] | 0 [b] | 0.032 (0.177 - 0.025) 8 | 100 | 0 |
| Cadmium (total) [b] | **27 | µg/L | 0.025 (0.120 - 0.006) 117 [b] | 100 [b] | 0 [b] | 0.028 (0.220 - 0.019) 8 | 100 | 0 |
| Chromium (total) [b] | 50 | µg/L | 0.29 (2.51 - 0.07) 117 [b] | 100 [b] | 0 [b] | 0.66 (5.05 - 0.48) 8 | 100 | 0 |
| Cobalt (total) [b] | 50 | µg/L | 0.50 (4.97 - 0.17) 117 [b] | 100 [b] | 0 [b] | 1.01 (4.03 - 0.73) 8 | 100 | 0 |
| Copper (total) | **30 | µg/L | 1.70 (21.00 - 0.32) 213 | 94.4 | 0 | 2.26 (12.7 - 1.64) 8 | 100 | 0 |
| Iron (total) | 300 | µg/L | 339 (14,500 - 14) 198 | 100 | 59.6 | 896 (5490 - 620) 8 | 100 | 100 |

* in historic dataset, values below detection limits (<) are included at ½ detection limit for median calculations; dataset is from 1991 - 2016 unless otherwise indicated
[a] E. coli sampling began in 2008. E. coli has multi-value objective: single sample maximum of 400 CFU/100mL, and seasonal (Apr-Oct) geomean of 126 CFU/100mL. Shown for 2018 is *geomean*, not median value.
[b] historic data calculated from 2003 – 2016 due to analytical method changes
**based on hardness of 300 mg/L ***un-ionized ammonia is calculated using temperature and pH, therefore % detectable is not applicable

2018 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY
US05NF0001 WESTHOPE

| WATER QUALITY PARAMETER | WATER QUALITY OBJECTIVE | UNITS | HISTORIC DATA* Median (max - min) #samples | HISTORIC DATA % detectable | HISTORIC DATA % exceedance | ANNUAL DATA 2018 Median (max - min) #samples | 2018 DATA % detectable | 2018 %exceedance |
|---|---|---|---|---|---|---|---|---|
| Lead (total) [b] | **13 | µg/L | 0.28 (5.17 - 0.03) 117 [b] | 100 [b] | 0 [b] | 0.85 (3.76-0.54) 8 | 100 | 0 |
| Mercury | 0.5 ug/g in fish flesh | µg/g | NS | NS | NS | NS | NS | |
| Molybdenum (total) | 10 | µg/L | 2.28 (35.2 - 0.50) 198 | 99 | 2.5 | 2.35 (7.75 - 1.59) 8 | 100 | 0 |
| Nickel (total) | **220 | µg/L | 3.14 (24.7 - <2.0) 213 | 93.4 | 0 | 4.67 (18.0 - 3.36) 8 | 100 | 0 |
| Selenium (total) | 5 | µg/L | 0.35 (1.81 - <0.05) 195 | 98.0 | 0 | 0.42 (0.89 - 0.33) 8 | 100 | 0 |
| Zinc (total) [b] | 30 | µg/L | 2.05 (13.50 - 0.30) 117 [b] | 100 [b] | 0 [b] | 3.5 (26.8 - 2.7) 8 | 100 | 0 |
| | | | | | | | | |
| **Miscellaneous** | | | | | | | | |
| Total Dissolved Solids | 1,000 | mg/L | 835 (3821 - 149) 212 | calculated | 29 | 995 (4107 - 783) 8 | calculated | 50 |
| Total Suspended Solids | the lesser of 10 mg/L or 10% over ambient | mg/L | 12.6 (155 - <1) 213 | 99.5 | 62 | 46 (158 – 30) 8 | 100 | 100 |
| pH (range) | 8.5-6.5 | standard units | 8.4 (10.0 – 7.1) 223 | 100 | 40 | 8.4 (9.1 - 7.6) 8 | 100 | 38 |
| Dissolved Oxygen (conc.) | >5.0 | mg/L | 8.44 (23.57 - 0.00) 222 | 100 | 19 | 7.8 (17.3 – 0.9) 8 | 100 | 25 |
| Aesthetics | | visual | NS | | | NS | | |
| Oil and Grease | | visual | NS | | | NS | | |
| | | | | | | | | |

* in historic dataset, values below detection limits (<) are calculated at ½ detection limit; dataset is from 1991 - 2016 unless otherwise indicated
[b] historic data calculated from 2003 – 2016 due to detection limit changes (however, no exceedances in detectable values before 2003)
**based on hardness of 300 mg/L
NS: Not Sampled
calculated: parameter calculated from other measured values, % detectable not applicable

2018 ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY
US05NF0001 WESTHOPE

| WATER QUALITY PARAMETER | WATER QUALITY OBJECTIVE | UNITS | HISTORIC DATA** Median (max-min) # samples | HISTORIC DATA % detectable | HISTORIC DATA % exceedance | ANNUAL DATA 2018 Median (max-min) # samples | 2018 DATA % detectable | 2018 %exceedance |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **Organic Parameters** | | | | | | | | |
| Atrazine | 2 | µg/L | 0.0160 (0.0464 - <0.0019) 77 | 68.8 | 0 | 0.0256 (0.0450 - 0.0098) 6 | 100 | 0 |
| Bromoxynil | 5 | µg/L | <0.0063 (0.2020 - <0.0002) 103 | 29.1 | 0 | 0.0001 (0.0126 - <0.0002) 6 | 33.3 | 0 |
| Carbaryl | 90 | µg/L | NS | | | NS | | |
| alpha-Chlordane | 0.0043 | µg/L | <0.0001 (<0.0001 - <0.0001) 100 | 0 | 0 | (< DL 0.0005) 6 | 0 | 0 |
| gamma-Chlordane | 0.0043 | µg/L | <0.0001 (0.0011 - <0.0001) 100 | 1.0 | 0 | (< DL 0.0004) 6 | 0 | 0 |
| DDT | 0.001 | µg/L | <0.0004 (0.0027 - <0.0004) 100 | 1.0 | 1 | (< DL 0.0018) 6 | 0 | 0 |
| Dieldrin | 0.0019 | µg/L | <0.0003 (0.0003 - <0.0003) 100 | 1.0 | 0 | (< DL 0.0013) 6 | 0 | 0 |
| Dicamba | In development | µg/L | 0.0089 (0.0451 - <0.0004) 103 | 47.6 | - | 0.0002 (0.1800 - < 0.0004) 6 | 33.3 | - |
| Diclofop-methyl | In development | µg/L | <0.0212 (<0.0074-<0.0074) 101 | 0 | - | (< DL 0.0116) 6 | 0 | - |
| Heptachlor | 0.0038 | µg/L | <0.0001(<0.0001 -<0.0001) 89 | 0 | 0 | NS | NS | |
| MCPA | 0.20 | µg/L | 0.0150 (0.3150 - <0.0006) 103 | 56.3 | 1.9 | 0.0059 (0.0359 - <0.0002) 6 | 83.3 | 0 |
| Parathion | 0.04 | µg/L | <0.0155 (<0.0155 - <0.0155) 33 | 0 | 0 | NS | NS | |
| Phenols (total) | 1.0 | µg/L | NS | | | NS | NS | |
| Picloram | 0.05 | µg/L | 0.0250 (0.1700 - <0.0006) 103 | 36.9 | 11.7 | 0.0043 (0.0118 - <0.0006) 6 | 50 | 0 |
| Polychlorinated biphenyl (PCB total) | 0.001 | µg/L | <0.0002 (<0.0002-<0.0002) 43 | 0 | 0 | NS | NS | |
| Triallate | 0.57 | µg/L | <0.0021 (0.0800 - <0.0022) 101 | 5.9 | 0 | (< DL 0.0044) 6 | 0 | 0 |
| Trifluralin | 0.10 | µg/L | <0.0026 (<0.0026 - <0.0026) 101 | 0 | 0 | (< DL 0.0026) 6 | 0 | 0 |
| 2,4-D | 4.0 | µg/L | 0.0445 (0.5870 - < 0.0005) 103 | 77.7 | 0 | 0.1354 (0.9160 - 0.0482) 6 | 100 | 0 |
| | | | | | | | | |

** For Pesticides, historic data values below detection limits (<) are calculated at ½ detection limit; dataset is from 1991 - 2016 unless otherwise indicated. There are frequently multiple detection limits within the date range. The maximum for parameters with only one detection over the period of record (DDT, Dieldrin, Gamma Chlordane) is given as the value of the single detection, although detection limits higher than that value may have occurred. The median is given as the median of all detection limits.

NS: Not Sampled

# APPENDIX F

# Water Quality Monitoring Plan for Sherwood and Westhope

Sherwood Monitoring Plan

| Season | No. of Site Visits | No. of Samples Per Year | | | | |
|---|---|---|---|---|---|---|
| | | Dissolved Oxygen | Major Ions | Nutrients | Trace Elements | E. coli |
| 1 (Mar-Jun) | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 (Jul-Oct) | 4 | 4 | 4 | 4 | 4 | 2 |
| 3 (Nov-Feb) | 1 | 1 | 1 | 1 | 1 | 0 |
| TOTAL | 7 | 7 | 7 | 7 | 7 | 4* |

*Working on updating monitoring activities to include 5 samples

Westhope Monitoring Plan

| Season | No. of Site Visits | No. of Samples Per Year | | | | | |
|---|---|---|---|---|---|---|---|
| | | Dissolved Oxygen | Major Ions | Nutrients | Trace Elements | Pesticides | E. coli |
| 1 (Mar-Jun) | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 (Jul-Oct) | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| 3 (Nov-Feb) | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| TOTAL | 8 | 8 | 8 | 8 | 8 | 6 | 8 |

# APPENDIX G

# Detailed Activities of the Board in 2018

## G1.0 2018 ACTIVITIES OF THE BOARD

Since the presentation of the Sixtieth Annual Report (2017) to the IJC, the Board has held two face to face meetings and one public meeting. The discussions and decisions made are summarized in the following sections.

### G1.1 2018 Spring Meeting

The Board held its annual spring meeting in Minot, North Dakota on February 21, 2018. Board members in attendance:

Garland Erbele, Frank Durbian, Mark Lee, Joe Goodwill, Scott Gangl, Dave Pattyson, Gregg Wiche, Debbie McMechan, Lorinda Haman, Shelly Weppler, David O'Connell, Jeff Woodward, Ken Bottle, Col. Samuel Calkins, David Glatt

Board members in attendance via conference call:

Russel Boals

The agenda for the Board's meeting included the following topics:

- Review of 2017 Hydrologic Conditions, Spring 2018 Hydrologic Forecast and Planned Operations.
- Compliance of Souris River Flows to December 31, 2017
- Update from the Hydrology Committee
- Water Quantity Monitoring
- Water Appropriations in the Souris River Basin during 2017
- Update from the Flow Forecasting Liaison Committee (FFLC)
- Update from the Aquatic Ecosystem Health Committee (AEHC)
- Compliance with Water Quality Objectives for 2017
- Water Quality Monitoring Plan
- ISRB Communications
- International Souris River Study Board (ISRSB) Update
- Update on Water Management Projects
- International Watershed Initiative Projects
- 2017 Souris River Basin Flood Report

#### G1.1.1 Review of 2017 Hydrologic Conditions, Spring 2018 Hydrologic Forecast and Planned Operations

##### *G1.1.1a Saskatchewan, Canada*

The Saskatchewan Water Security Agency (WSA) reported that on November 22, 2017 Alameda Dam and Alameda Reservoir were renamed to Grant Devine Dam and Grant Devine Lake, respectively.

WSA reported that the 2018 spring runoff forecast was well below normal as of February 15, 2018. There was record or near record non-precipitation from April 1 to October 1, 2017, over the western portions of the basin, and 40 to 60 percent of normal fall precipitation from September 3 to November 1, 2017. With the assumption of average precipitation for the remainder of the season and a normal melt, the forecasted runoff results in an event less than a 1:10 year event. Therefore, no additional pre-runoff flood operation drawdowns, beyond the normal drawdowns, were required.

*Based on the projected runoff volumes, the apportionment split was determined to be 50/50 according to Annex B of the 1989 International Agreement.*

### G1.1.1b North Dakota, United States of America

The United States Geological Survey (USGS) reported the total volume of flow past the Long Creek near Noonan gage for the 2017 calendar year was 38,440 acre-feet (47,416 cubic decametres). This volume was about 236 percent greater than the median volume for the past 58 years. Flows were in the normal to above normal range. The peak discharge for January 1 to December 31, 2017 is was 2,160 cfs (61 cms), which ranked 15 in 58 years of record.

The total volume of flow past the Souris River near Sherwood gage for the 2017 calendar year was 108,300 acre-feet (133,588 cubic decametres). The total volume was 200 percent greater than the median volume for the past 87 years. The peak discharge for the period January 1 to December 31, 2017 was about 1,850 cfs (52 cms).

The total volume of flow recorded at the Souris River near Westhope gage for the 2017 calendar year was 569,200 acre-feet (702,109 cubic decametres). The total volume was about 473 percent of the median volume for the last 88 years. Flows for 2017, based on the past 88 years of record were in the above normal range. The peak discharge for the period January 1 to December 31, 2017 was 8,360 cfs (237 cms), which ranked 3rd in 88 years of record. The minimum flow for the period was 4.25 cfs (0.12 cms).

The United States Fish and Wildlife Service (USFWS) provided a summary of refuge operations and flows for 2017. Total yearly provisional flow at Sherwood was 108,875 acre-feet (134,298 cubic decametres). This was 92 percent of the historic average annual inflow, which is 118,143 acre-feet (145,730 cubic decametres) for the period of record from 1938-2017. Total yearly provisional outflow measured at the Souris River near Foxholm gage on the south end of the Upper Souris National Wildlife Refuge was 117,873 acre-feet (145,397 cubic decametres) for the period 1938-2017. This was 97 percent of the historic average annual outflow, which is 120,905 acre-feet (149,137 cubic decametres) for the period of 1938-2017. Total outflow was 8,998 acre-feet (11,099 cubic decametres) more than the total measured inflow. On December 31, 2017, Lake Darling was at an elevation of 1595.76 ft (486.39 m).

Total outflow measured at Westhope for 2017 was 554,577 acre-feet (684,072 cubic decametres). Total outflow was 326,842 acre-feet (403,160 cubic decametres) more than inflow on the Souris River at Bantry. Outflow during the June 1 to October 31 period was 19,194 acre-feet (23,676 cubic decametres) or 13,125 acre-feet (16,190 cubic decametres) above the 6,069

acre-feet (7,486 cubic decametres) required minimum. The flow at the Westhope gage fell below the minimum 20 cfs (0.57 cms) threshold twelve days during the June 1 to October 31 period, due to a combination of relatively low flows and wind fetch. The target flow was missed from October 12 to 19, 24, 26 to 27, and 30 to 31. The lowest recorded daily mean flow during the June 1 to October 31 time period was 4.25 cfs (0.12 cms) and occurred on October 27, 2017.

Along with typical operations, the USFWS experimented with holding Lake Darling's June 1st target level at 1596.0 ft (486.46 m) in the summer of 2017 in an attempt to create storage for late summer rains that have been causing issues the past few years. Substantial summer rainfall did not occur, which caused Lake Darling to enter the summer with a deficit.

### G1.1.1c Manitoba, Canada

Manitoba Sustainable Development (MSD) reported that the 2017 spring melt started in late March, with the Manitoba tributaries and main stem experiencing rapid rises until a peak occurred in early April. The melt produced high runoff, which produced a peak on the Souris River at Wawanesa at 525 cms (18,500 cfs) on April 5th, which is considered to be a 40-year flood event. Only the floods of 1882, 1904, 1976, and 2011 exceeded the 2017 peak flow at Wawanesa. After the spring freshet, flows continuously declined on the main stem reaching the lower portion of the normal range from July 1st to winter freeze up.

At the end of January 2018, the U.S. Drought Monitor and Canadian Drought Monitor maps placed the Souris River Basin under moderate drought conditions, with severe to extreme conditions in the headwaters portion of the basin. The flow at Wawanesa on January 13, 2018, was 0.25 cms (8.8 cfs), within the normal range, but near the 25th percentile.

The Manitoba Hydrologic Forecasting and Coordination Branch has reported that the risk of flooding for the spring of 2018 remains low for the entire province and the National Weather Service's probabilistic forecast at the North Dakota-Manitoba border shows the probability of 2018 spring flooding as much lower than the historical average. The Manitoba portion of the Souris River Basin has received below normal snow cover in winter 2017/2018. Environment and Climate Change Canada's (ECCC) February 13, 2018, snow survey shows 20 to 40 mm (0.8 to 1.6 inches) of snow water equivalent across the basin, with slightly more at the very downstream end.

### G1.1.2 Compliance of Souris River Flows to December 31, 2017

ECCC outlined the results of natural flows for the period ending in December 31, 2017. The total diversion in the Souris River Basin was 83,431 cubic decameters (67,638 acre-feet). Recorded flow at Sherwood was 133,576 cubic decameters (108,290 acre-feet). The natural flow computed at Sherwood was 198,692 cubic decameters (161,080 acre-feet). According to these computations, the U.S. share at 40 percent was 79,480 cubic decameters (64,434 acre-feet). The flow received by the U.S. was 135,571 cubic decameters (109,907 acre-feet), which constitutes a surplus delivery of 56,091 cubic decameters (45,473 acre-feet). These flows were very close to average. The annual flow requirement / apportionment at Long Creek station was met with a surplus of 19,829 cubic decameters (16,075 acre-feet).

### G1.1.3 Update from the Hydrology Committee

The Hydrology Committee reported that progress regarding the Apportionment Procedures Manual for the Souris River has been slow. The Hydrology Committee refocused their effort and planned on producing a simplified procedures manual for the computation of natural flows and the determination of the apportionment with a supplemental document containing the details and history of the Hydrology Committee and the development of the apportionment determinations. The Hydrology Committee planned to have a final draft of the simplified procedures manual at the June meeting.

### G1.1.4 Water Quantity Monitoring

ECCC reported that the water monitoring network for 2018 would remain the same as 2017. The only plans are to move a stand-alone weather station at Handsworth to Moose Mountain Lake Hydrometric Station. The weather station collects data for windspeed, humidity, temperature, radiation and has a tipping bucket. The intent on moving the station was to consolidate the stations. There were no foreseen issues with the movement of the station.

USGS reported that there were no expected changes to the stream gaging network in the U.S. in 2018. The USGS raised concerns related to the aging gage infrastructure and the stress caused by the 2011 flood. There were several stations poised to fall into the river and with the predicted drier season, the USGS was performing site work in 2018.

### G1.1.4 Water Appropriations in the Souris River Basin During 2017

WSA reported that seven Approvals to Operate, with a combined allocation of 220 cubic decameters (178 acre-feet), within the effective drainage area of the basin were canceled in 2017. There were three Approvals to Operate, with a combined allocation of 450 cubic decameters (365 acre-feet), within the effective drainage area of the basin approved in 2017. Of the 10 projects that were canceled or approved, only six of the cancelled projects would meet the criteria for minor project diversions and none of the approved projects would.

NDSWC reported that there were two conditional groundwater water permits issued in 2017, with a combined allocation of 170 acre-feet (210 cubic decameters), and eight temporary groundwater permits with a combined authorized use of 249 acre-feet (307 cubic decameters). There were also three conditional surface water permits issued in 2017, with a combined allocation of 171 acre-feet (211 cubic decameters), and 40 temporary surface water permits with a combined authorized use of 919 acre-feet (1,133 cubic decameters). The majority of the temporary surface water permit's authorized use was from isolated sloughs that normally make minimal contributions to the basin.

### G1.1.5. Update from the Flow Forecasting Liaison Committee (FFLC)

The FFLC reported on recent activities which consisted of coordination on a February 1st and February 15th spring outlook. The FFLC reported that the spring outlook of dry weather did not

warrant additional conference calls and the FFLC planned to continue to coordinate forecasts on the first and fifteenth of each month until runoff commences.

### G1.1.5. Update from the Aquatic Ecosystem Health Committee (AEHC)

The AEHC reported that members of the committee discussed potential changes to the presentation of water quality data in the Annual Report via conference call on January 17th. The discussion ended on the conclusion that the Board's input was needed about the requirement obligation of the AEHC concerning the level of detail necessary for reporting objectives that have not been met. AEHC noted that the 1989 Agreement includes a provision for the establishment of a Joint Water Quality Program (Program). Article IV of the 1989 Agreement states: *boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health of property on the other.* Article IV also provides guidelines for the Program group, which include:

- Develop recommendations for water quality objectives
- Exchange data provided by the Program
- Collate
- Interpret and analyze Program data
- Review the Program and water quality objectives every five years
- Recommend modifications

Article IV also requires the submission of an annual report and if the report indicates that water quality objectives are not being attained, the Parties shall begin consultations to determine how the water quality objectives can be met, or otherwise addressed.

The AEHC provided the following suggestions, with examples, for how to move forward with the 2017 annual report:

- Limit reviewed data to 10 to 15 years past
- Use other historic data in summaries of exceedances only
- Standardize the report to look like the Water Quality Section in the International Red River Basin Report
- Move to a Water Quality Index that has guideline limit to reflect the Water Quality Objectives and is calculated on a three-year rolling average that is more exceedance based for an overall health report
- Or a combination of the bullets above

The North Dakota Department of Health (NDDOH) offered to prepare the suggestions for future reporting at the June meeting so that the Board could provide comments.

### G1.1.6. Compliance with Water Quality Objectives for 2017

The NDDOH presented a summary of the water quality monitoring program for the Sherwood site and ECCC presented the data for the Westhope site. The USGS collected eight water quality samples from the Souris River at Sherwood, ND and the ECCC collected seven samples at

Westhope, ND, and one sample at the alternate site at Coulter, MB, because of access. The following exceedances were highlighted:

Sherwood –

- Total Phosphorus exceeded its Water Quality Objective of 0.10 mg/L for all samples collected in 2017. Values ranged from 0.12 mg/L in June to 0.34 mg/L in April.
- Sodium exceeded its objective of 100 mg/L for 7 of the 8 samples. Results ranged from 71.9 mg/L in April to 326 mg/L in October.
- Sulphate exceeded its objective of 450 mg/L on two occasions with a minimum value of 258 mg/L in April and a maximum concentration of 568 mg/L in October.
- Total Dissolved Solids exceeded the Water Quality Objectives of 1000 mg/L twice in 2017. The minimum value was 510 mg/L, observed in April, the maximum value was 1,370 mg/L in October.
- Total iron exceeded its water quality objective of 300 µg/L six times. The minimum value was 198 µg/L in July, and a maximum value of 3,770 µg/L in April.
- Chloride, Boron, pH and Dissolved Oxygen, which have had exceedances in the past, did not exceed their respective Water Quality Objectives in 2017.

Westhope –

- Total Phosphorus exceeded its Water Quality Objective 0.10 mg/L for all samples collected in 2017. Values ranged from 0.163 mg/L in January to 0.429 mg/L in September.
- Sodium exceeded its objective of 100 mg/L for 7 of 8 samples. Results ranged from 35 mg/L in April to 265 mg/L in September.
- Sulphate exceeded its objective of 450 mg/L on five occasions. The minimum value was 133 mg/L in April and the maximum concentration was 699 mg/L in September.
- Total Dissolved Solids exceeded the Water Quality Objectives of 1000 mg/L four times in 2017. The minimum value was 354 mg/L in April and the maximum value was 1,451 mg/L, which was observed in January.
- Total iron exceeded its water quality objective of 300 µg/L six times. The minimum value was 171 µg/L in June and the maximum value was 3,380 µg/L in September.
- pH exceeded the Water Quality Objective of 8.5 pH units three times in 2017 and equaled it twice. The maximum value of 9.81 was recorded in July.
- Dissolved Oxygen (DO) concentrations were below the 5 mg/L Water Quality Objective in two samples, one in January and one in February.
- *E. coli* was at a high value of 420 colonies /100 ml in September.
- Fecal coliform - Fecal coliform exceeded the Water Quality Objective of 200 colonies per 100 ml once in September of 2017, with a value of 380 colonies per 100 ml.

NDDOH proposed submission of an IWI proposal to place continuous DO monitors on the river. The Board moved to place the AEHC Dissolved Oxygen IWI Study Proposal Summary to the AEHC's reporting.

### G1.1.7 Water Quality Monitoring Plan

No changes are anticipated with the Water Quality Monitoring Plan for 2018.

### G1.1.8 Board Communication

The IJC reported that earlier in the year a letter was sent to the Board's Co-Chairs and Co-Secretaries that outlines the IJC's new approach to handling communications. The IJC has gathered a dedicated communications staff for each Board. The Board's communication staff member through the IJC is Sarah Lobrichon from the Canadian section of the IJC.

The IJC also reported that they were in the process of improving their website. The website was being revamped so that the IJC and each Board would have their own website. The revamp was scheduled to be completed by June of 2018.

### G1.1.9 International Souris River Study Board Update (ISRSB)

The Study Managers, Co-Chairs, and Board Members of the International Souris River Study Board (ISRSB) provided an update and overview of the Plan of Study. The International Souris River Study (Study) focus is reviewing and updating the 1989 International Agreement for operating Rafferty, Grant Devine, Boundary, and Lake Darling Dams. The 2011 flood in the Souris River Basin inspired the Board to produce the 2013 Plan of Study, which proposed three different options. The Governments of Canada and the United States approved moving forward with the recommended option for the new Study, appointed the ISRSB, and provided them with a reference document. The reference provided was for a total of $1,800,000, split between both Federal Governments. The Study due date was March of 2020.

The reference covers eleven points that were matters of concern raised by the Governments. The ISRSB has to evaluate and make recommendations for each, which are as follows:

- Data harmonization
- Development of water supply flows
- Evaluate operational scenarios
- Study physical processes of flooding
- Operating plan review
- Evaluate infrastructure and operating alternatives
- Evaluate additional flood protection measures
- Assess adaptation strategies
- Facilitate collaboration
- Recommend changes to operating plans
- Anything else deemed important

The overall purpose of the Plan of Study is to review all of the elements of the Agreement between Canada and the United States and to make recommendations for improvements in areas that are either unclear or could be done in a more efficient manner. Once the ISRSB has finished

their investigation, the results will be presented to the IJC who then works with the Federal Governments to incorporate the improvements into the Agreement.

The Study is divided into the following four parts:

- Operating Rules Review: evaluate and clarify the language used in Annex A, the operating plan for the reservoirs, and Annex B, the apportionment agreement.
- Data Collection and Management: inventory the available and required data and considerations for various operating scenarios and fill in gaps of missing information.
- Hydrology and Hydraulics: set up the modeling platforms that will be used to test different operating scenarios.
- Plan Formulation: processing all of the gathered information in order to provide recommendations.

### G1.1.10 Update on the Water Management Projects

NDSWC provided an update on the Northwest Area Water Supply Project (NAWS). The update included details on the status of appeals issued by the defendants, Manitoba and Missouri, and an update on the design of a biota water treatment plant. MSD added that on January 31, 2018, the courts issued a 90-day period of negotiation. Court has been delayed for 90-days for Manitoba to negotiate a settlement with North Dakota.

### G1.1.11 International Watershed Initiative (IWI) Projects

IJC noted that the call for IWI proposals would be closing in March or April, and that staff would be available to help with any submissions. It was also noted that the semi-annual meeting will be held during the week of April 23rd, in Washington, DC.

### G1.1.12 2017 Souris River Basin Post Flood Report

United States Army Corps of Engineers (USACE) reported that the 2017 Post Flood Report has been sent as a draft. There were no additional comments made and copies of the report will be available to anyone upon request.

## G1.2 2018 Summer Meeting

The Board held its annual summer meeting in Estevan, Saskatchewan on June 26, 2018. Board Members in attendance:

Russell Boals, Garland Erbele, Frank Durbian, Nicole Armstrong, Mark Lee, Joe Goodwill, Scott Gangl, David Pattyson, Gregg Wiche, Debbie McMechan, Lorinda Haman, Shelly Weppler, David O'Connell, Jeff Woodward, Colonel Samuel Calkins, John Fahlman

The agenda for the Board's meeting included the following topics:

- Determination of Natural Flow of the Souris River at Sherwood to May 31, 2018
- Update from the Hydrology Committee
- Review of 2018 Hydrologic Conditions, Operations, and Hydrologic Forecasts
- Flow Forecasting Liaison Committee (FFLC) Update
- Aquatic Ecosystem Health Committee (AEHC) Update
- Compliance with Water Quality Objectives for 2017
- International Watershed Initiative Projects
- International Souris River Study Board Update
- Update on Water Management Projects
- ISRB Communication
- International Souris River Board Work Plan

### G1.2.1 Determination of Natural Flow of the Souris River at Sherwood to May 31, 2018

ECCC reported the results of the natural flows determined for the period ending May 31, 2018. The total diversion in the Souris River Basin was 16,153 cubic decameters (13,095 acre-feet). Recorded volume at Sherwood was 12,878 cubic decameters (10,440 acre-feet). The natural volume computed at Sherwood was 29,029 cubic decameters (23,534 acre-feet). The United States share at 50 percent was 14,510 cubic decameters (11,763 acre-feet). The flow received by the U.S. was 14,571 cubic decameters (11,813 acre-feet), which constitutes a surplus delivery of 61 cubic decameters (49 acre-feet).

The annual flow requirement / apportionment at Long Creek was also been met with an increase of 1,501 cubic decameters (1,217 acre-feet) between the Western Crossing and Noonan.

It was confirmed that the apportionment for 2018 would be a 50/50 split between Canada and the United States. The Board approved the Natural Flow Computations to May 31, 2018.

### G1.2.2 Update from the Hydrology Committee

During the February Hydrology Committee conference call, the decision was made to change the approach to the Procedures Manual assignment. The first step identified was to document the present *Procedures for the Diversions of Waters of the Souris River*, then address improvements to the procedures. WSA prepared a report documenting the current procedures used for the apportionment determination, which the Hydrology Committee distributed to the Board.

The Board created the Natural Flows Committee to review the apportionment procedures, but the task was set aside during the construction of the two Canadian dams because of the potential impacts they may have concerning apportionment. The Hydrology Committee would revisit the report to determine improvements that could be made. Potential improvements or known areas of concern are listed in the appendix of the report as distributed by the Hydrology Committee. The Hydrology Committee recognized that there was a need for a significant update to the procedures, program and software, but recommended delaying major revisions until the outcome of the Study is available in case there are changes or implications as a result of the Study recommendations.

### G1.2.3 Review of 2018 Hydrologic Conditions, Operations, and Hydrologic Forecasts

#### *G1.2.3a Saskatchewan, Canada*

WSA conducted manual point snow surveys in March of 2018 that indicated 13 mm (0.51 inches) to 70 mm (2.76 inches) of Snow Water Equivalent. The snowpack was estimated to range from near normal on the east side of the basin to well below normal on the west side.

Forecasts were issued February 1 and 15, March 1 and 15, and April 1. The first three forecasts indicated well below normal runoff volumes that increased slightly with a significant snowfall event in early March. The basin was still expected to receive below normal runoff with no additional drawdown requirements. Given non-flood operations and based on Sherwood natural flows, which are expected to be less than 50,000 cubic decameters (40,535 acre-feet), the apportionment was confirmed to be a 50/50 split.

Runoff generally began in the basin on April 15, 2018. Zero runoff was observed within many of the tributary basins, particularly upstream of Rafferty, and large losses to infiltration resulted in runoff yields being lower than forecasted. All inflows to Boundary, Rafferty and Grant Devine Dam were stored and the Boundary to Rafferty Diversion works were not used. None of the Canadian Reservoirs reached their full supply level.

Conditions following the snowmelt were very dry, with only 10-50 percent of normal rainfall from April 28 to May 27. Lower portions of the Moose Mountain Creek Basin received in excess of 167 mm (6.6 in) of rainfall between May 27 and June 2. Much of the rain fell on June 1-2 with 120 mm (4.7 in) at Wilmar, SK, with localized reports of higher accumulations and flooding at Lampman and Alameda. There were also significant accumulations in areas above Weyburn.

Grant Devine Dam would continue releases throughout the summer until the reservoir was down to 561.8 m, to leave a buffer for smaller summer events. More water would be released if necessary, for apportionment obligations. Rafferty Dam would make releases as needed to replenish downstream water supplies. It was unlikely that there would be any releases from Boundary Dam. Drawdown operations would be initiated if needed to meet the February 1, 2019 normal drawdown obligations prior to the 2018 freeze-up.

### *G1.2.3b North Dakota, United States of America*

USGS reported that a new gaging station for the Souris River would be installed at Broadway Bridge in Minot, ND. The gage would be stage only and the USGS would make occasional discharge measurements at targeted flows to develop a stage-discharge relationship for the National Weather Service to use for flood forecasting. The operation and maintenance of the gage was funded by the Souris River Joint Board and the Ward County Water Board. It would be a real-time gage and be available on the USGS website later in the summer.

USGS reported the total volume of flow past the Long Creek near Noonan gage through May 31, 2018 calendar year was 4,180 acre-feet. (5,156 cubic decameters). This volume is about 27% of the median for the past 58 years. Flows for the current year are in the below normal to above normal range. Peak discharge for the reporting period January 1 to May 31, 2018 was 307 cfs (8.7 cms), on April 22, which ranked 41$^{st}$ in 58 years of record.

The total volume of flow past the Souris River near Sherwood gage through May 31, 2018 calendar year was 10,500 acre-feet (12,947 cubic decameters). This volume was about 19 percent of the median for the past 87 years. Flows for the current year, based on the last 87 years of record, were in the below normal to above normal range. The peak discharge for the period January 1 to May 31, 2018 was about 542 cfs (15.3 cms) on April 20, which ranked 61$^{st}$ in 87 years of record.

The total volume of flow past the Souris River near Westhope gage, through May 31, 2018, was about 4,970 acre-feet (6,128 cubic decameters). The calendar year's total volume is about 4.1 percent of the median for the past 88 years. Flows for the current year, based on the last 88 years of record, were in the much below normal to normal range. The peak discharge for the period January 1 to May 31, 2018 was 143 cfs (4.0 cms) on May 9, which ranked 77$^{th}$ in 88 years of record. There was zero flow at the Souris River near Westhope gage from early January until the end of March, which was believed to be a result of the channel freezing down.

The USFWS presented a summary of refuge operations in North Dakota. The total provisional inflow measured at Sherwood for the first five months of the year was 10,457 acre-feet (12,899 cubic decameter). This was 13 percent of the historic January-May average inflow, which is 82,559 acre-feet (101,837 cubic decameters) for the period 1938 through 2018.

The Upper Souris National Wildlife Refuge pool volume increased an estimated 9,309 acre-feet (11,482 cubic decameters) during the first five months of the year. The total provisional outflow measured at Foxholm on the south end of the refuge for the first five months of 2018 was 2,507 acre-feet. (3,092 cubic decameters). This outflow was 4 percent of the historic January-May average outflow, which is 70,636 acre-feet (87,130 cubic decameters) for the period 1938 through 2018. Lake Darling elevation increased 0.86 ft (0.26 m) from 1595.76 ft (486.39 m) on January 1 to 1596.62 ft (486.65 m) on May 31.

The total provisional inflow for J. Clark Salyer National Wildlife Refuge for the period January 1 to May 31, 2018 was 18,334 acre-feet (22,615 cubic decameter). This inflow was 17 percent of the historic record January-May inflow, which is 107,007 acre-feet (131,993 cubic decameter)

for the period of 1938 through 2018. Total pool volume on May 31 was 37,603 acre-feet (46,383 cubic decameter). This was 12,806 acre-feet (15,796 cubic decameter) above the January 1 volume of 24,797 acre-feet (30,587 cubic decameter). Approximately 4,965 acre-feet (6,124 cubic decameter) was passed to Manitoba during the five-month period.

### *G1.2.3c Manitoba, Canada*

MSD reported that the 2018 spring melt began in early to mid-April. The Manitoba tributaries experienced below normal runoff. Flood peaks were well below normal and corresponded to a 1-in-5-year low flow event, meaning that these peaks have been exceeded in 80 percent of the years on record. The Souris River peaked at Wawanesa on April 21st at approximately 23.7 cms (836.8 cfs). This corresponds to approximately a 1-in-4-year low flow event, or exceeded in 75 percent of the years on record.

It was reported that April and the first few weeks of May were extremely dry in Manitoba leading to growing concern over drought. Mid-May precipitation improved conditions, but it was expressed that additional rain would be beneficial in some areas.

Some flow was generated in most tributaries and the main stem of the Souris River, which caused the Souris River to rise into the normal flow range as a response to the May and June rains. The Souris River peaked at 31.1 cms (1,098 cfs) at Wawanesa on June 15th and has been receding steadily. The flow at Wawanesa prior to the meeting was 14.5 cms (512 cfs), which is slightly above the median value of 13.0 cms (459 cfs) for this time of the year.

## G1.2.4 Flow Forecasting Liaison Committee (FFLC) Update

It was reported that with 2018 being a non-flood event, the FFLC had minimal activity. Five forecasts were produced and distributed to the committee between February 1st and the start of runoff on April 14th. With the expectation of a well below normal snowmelt runoff and no operation decisions to discuss, the FFLC did not host conference calls in 2018. The committee provided updates, via email, on WSA's operational plans that included the early June rainfall event.

Members of the FFLC planned on participating in the Study's forecasting workshop in July in St. Paul.

## G1.2.5 Aquatic Ecosystem Health Committee (AEHC) Update

The AEHC held a conference call on January 18th, a meeting on June 25th, and were in the process of scheduling a conference call for July.

ECCC has compiled the initial Water Quality Index that was discussed at the prior Board meeting. ECCC is also in the process of updating the Water Quality Data Tables included in the Board's Annual Report. Percent exceedances and percent non-detects for historical data have been included in support of the AEHC's Water Quality Objective Review. The additional information would aid in identifying problem parameters from non-problem parameters.

Along with the updated Water Quality Data Tables for the Annual Report, the AEHC is considering the inclusion of Aquatic Nuisance Species (ANS) into their reporting. The topic would include how each jurisdiction manages ANS, including decontamination and monitoring procedures. While the Souris River Basin for the most part is free of ANS, Zebra Mussels have been found in Lake Winnipeg, and more recently the Red River of the North. AEHC members stated that they were almost finished with the draft that would be included with the 2017 AEHC report and asked if the Board had any direction to provide for the 2018 reporting.

The AEHC indicated that it was in the process of submitting a proposal for possible IWI funding. The proposal concerns the placement of a continuous Dissolved Oxygen (DO) monitoring station at the Sherwood USGS Gage site and another station located in the City of Minot, ND. Comments have been received from the IJC and are currently being incorporated into the application. Once completed the draft would be submitted to the AEHC for final review prior to review by the ISRB and formal submission in October.

The AEHC was considering the future submission of an IWI grant to review the committee's current Water Quality Objectives, primarily based on those objectives which report consistent exceedances. The goal was to investigate how other jurisdictions address those parameters, the science behind the values, and potential modifications to those objectives that are more appropriate for the Souris River Basin.

The AEHC reported that the Water Quality Monitoring Plan would remain the same at both sites for 2018.

### G1.2.6 Compliance with Water Quality Objectives for 2017

ECCC presented a summary of the water quality monitoring program. ECCC collected a total of seven water quality samples, five during open water and two under ice cover, from the Souris River in 2017 at the Westhope site and one water quality sample during open water at the alternate site of Coulter, MB. USGS collected a total of eight water quality samples, six during open water and two under ice cover, from the Souris River at the Sherwood site in 2017. The following exceedances of ISRB Water Quality Objectives were highlighted for the Sherwood and Westhope sites:

**Sherwood-**

- Total Phosphorus exceeded the Water Quality Objective of 0.10 mg/L in all samples collected in 2017. Values ranged from 0.12 mg/L in June to a maximum value of 0.34 mg/L in April.
- Sodium exceeded the objective of 100 mg/L for 7 of the 8 samples in 2017. Values ranged from 71.9 mg/L in April to a maximum value of 326 mg/L in October.
- Sulphate exceeded the objective of 450 mg/L on 2 occasions in 2017. Values ranged from 258 mg/L in April to a maximum value of 568 mg/L in October.
- Total Dissolved Solids exceeded the Water Quality Objective of 1000 mg/L for 3 samples in 2017. Values ranged from 510 mg/L in April to a maximum value of 1,370 mg/L in October.

- Total iron exceeded the water quality objective of 300 µg/L 6 out of 8 times in 2017. Values ranged from 198 µg/L in July to a maximum value of 3,770 µg/L in April.
- pH did not exceed the Water Quality Objective of 8.5 pH units and 6.5 units in 2017. Values ranged from 7.9 in July to a maximum value of 8.3 in April and October.
- Molybdenum did not exceed the Water Quality Objective of 10 µg/L in in 2017. Values ranged from 1.6 µg/L to a maximum value of 7.2 µg/L in October.
- Dissolved Oxygen (DO) concentrations remained at or above the 5 mg/L Water Quality Objective for all samples in 2017, with the lowest value of 5.2 mg/L occurring in July.
- *E. coli* did not exceed the proposed maximum Water Quality Objective of 400 colonies /100 ml for the 4 samples in 2017. Values ranged from 150 colonies /100 ml in July to a maximum value of 340 colonies /100 ml in August.
- Fecal coliform - No data collected.
- Chloride did not exceed the Water Quality Objective of 100 mg/L in 2017. Values ranged from 9.1 mg/L in April to a maximum value of 83.7 mg/L in October.
- Organics – Pesticide data were collected from April through October, excluding September.
- 2, 4-D, Atrazine, and MCPA were detected, but well below the Water Quality Objectives of 4.0 µg/L, 2.0 µg/L and 0.2 µg/L respectively.
- The ND Department of Agriculture tested for 103 different pesticides. Besides those mentioned on the Water Quality Objectives above, 20 others were detected.
- Total Boron did not exceed the objective of 500 µg/L in 2017. Values ranged from 128 µg/L in April to a maximum value of 438 µg/L in October.

**Westhope –**

- Total Phosphorus exceeded the Water Quality Objective 0.10 mg/L for all samples collected in 2017. Values ranged from 0.16 mg/L in January to 0.43 mg/L in September.
- Sodium exceeded the objective of 100 mg/L in 7 of 8 samples in 2017. Values ranged from 35 mg/L in April to 265 mg/L in September.
- Sulphate exceeded the objective of 450 mg/L in 5 of 8 samples in 2017. Values ranged from 133 mg/L in April to 699 mg/L in September.
- Total Dissolved Solids exceeded the Water Quality Objectives of 1000 mg/L in 4 of 8 samples in 2017. Values ranged from 354 mg/L in April to 1,451 mg/L in January.
- Total iron exceeded the water quality objective of 300 µg/L 6 out of 8 times in 2017. Values ranged from 171 µg/L in June to a maximum value of 3,380 µg/L in September.
- pH exceeded the Water Quality Objective of 8.5 pH units in 3 out of 8 samples in 2017. Values ranged from 7.06 in February to a maximum value of 9.81 in July.
- Molybdenum did not exceed the Water Quality Objective of 10 µg/L in 2017. Values ranged from 2.1 µg/L in April to 5.1 µg/L in January.
- Dissolved Oxygen (DO) concentrations remained at or above the 5 mg/L Water Quality Objective for 6 out of 8 samples in 2017, with the lowest values of 3.45 mg/L and 1.96 mg/L occurring in January and February respectively.
- *E. coli* exceeded the proposed maximum Water Quality Objective of 400 colonies /100 ml one time in 2017, with a value of 420 colonies /100 ml on September 17.

- Fecal coliform - Fecal coliform exceeded the Water Quality Objective of 200 colonies per 100 ml once in 2017, with a value of 380 colonies /100 ml on September 17.
- Chloride did not exceed the Water Quality Objective of 100 mg/L in 2017.
- Organics – Pesticide samples were collected April to September. Detections were quantifiable, however, much lower than their Water Quality Objectives, except for Picloram.
- Atrazine, Bromoxynil, MCPA, Picloram and 2,4-D were detected. Picloram exceeded the objective of 0.05 µg/L in April and June. No other pesticides exceeded the objectives.
- Total Boron did not exceed its objective of 500 µg/L in 2017. Values ranged from 62.7 µg/L in April to a maximum value of 252 µg/L in January.

ECCC then presented the Water Quality Index that was developed by the Canadian Council of Ministers of the Environment (CCME) to provide a simple overall rating for a given site and time period that is translated from complex water quality data.

The Water Quality Index calculations are based on three factors:
- The number of variables that are not complying with water quality objectives
- The frequency at which the objectives are not met
- The amount by which a sampled parameter exceeds the objective

Using the Canadian Environmental Sustainability Indicator Calculator, a Water Quality Index can be derived for sample data which has five index categories: Poor, Marginal, Fair, Good, or Excellent. ECCC also noted that the Water Quality Index user guide recommends the use of ten to fifteen parameters and she provided an example of what the observed WQI for the Sherwood and Westhope sites would look like, using the following parameters: 2,4-D, MCPA, Picloram, Arsenic, Boron, Lead, Nickel, Zinc, Nitrate/Nitrites, Phosphorus, Oxygen, pH and Total Suspended Solids. Covering a date range from 1999 to 2017 in three-year categories, the Sherwood site samples fell within the Marginal Category from 1991 to 1998 and 2006 to 2008, and the Fair Category for the remainder of the years. The Westhope site samples were in the Marginal Category from 1991 to 1995, 2000 to 2010, and 2011 to 2015, and the Fair Category for the remainder of the years. It was noted that presentation was only a demonstration of CCME and how it works, noting that it could be a potential tool for the Board.

### G1.2.7 International Watershed Initiative Projects

#### *G1.2.7a Update on IJC's Strategic Initiatives*

The IJC received a letter from the United States and Canadian Governments in response to a number of topics raised by the Board during its appearance at the April IJC meetings. The first item pertains to the Board's desire to include *E. coli* as a Water Quality Objective that was put forward and recommended by the IJC to the Governments. The letter confirmed their agreement that *E. coli* should be included as a Water Quality Objective. It was noted that the Environmental Protection Agency (EPA) desired for a higher sampling frequency, which prefers having a sample size consisting of twelve samples, but ultimately it was up to the Board to decide if a sample size of eight will provide enough resolution.

The SPARROW Water Quality Monitoring Project was expanded from the Red-Assiniboine Basin Model to include all of the Great Lakes. It was being called the Mid-Continent model and was going through the USGS review process. It was anticipated that the review process would be finished by the end of the year. Once the model review was complete and the model ready to be used, it would signify the end of the SPARROW Water Quality Monitoring Project initiative, unless something came up.

The Data Harmonization Project is approaching its final phase. It was expected that a year is required to finish transboundary harmonization in some key areas, but the data harmonization for the Souris River Basin was fully developed.

Discussion from these initiatives lead to two action items. The first would be to consider applying for IWI funding for the Procedures Manual and the second would be to consider applying for IWI funding for a Communications Infographic.

***G1.2.7b Board participation in the IJC's Climate Change Guidance Framework Pilot***

The IJC reported that their Climate Change Guidance Framework Pilot has four steps that would be able to provide guidance for Boards to investigate climate change affects from current and future activities in the basin. The horizontal portion of the Pilot was the first step of the Guidance Framework, which the Board participated in, along with other boards. The vertical portion is the remaining three steps, which were completed by the St. Croix Watershed Board. They were seeking feedback from all of the boards that have not completed the vertical portion in order to estimate the individual board's interest. It was noted that there was a narrated video of how the St. Croix Board accomplished the vertical portion on the IJC website.

The Climate Change Guidance Framework is broken down into four steps. The first step was Organize, which is for the boards to compile all of the objectives they are trying to achieve. Step two is Analyze, in which the board studies the possible outcomes of achieving those objectives. The board then decides upon the best possible outcomes that are desired and their plausibility. Step three is Act, where the board decides which of the outcomes they are able to change and possible actions to implement to address the identified concerns. Step four is Update and Document the process. The IJC expounded that as part of the semi-annual meeting in the fall there would be a workshop covering climate change and the Climate Change Guidance Framework Pilot.

***G1.2.7c Update on the IJC's website refresh***

The Public Affairs Advisor for the Canadian Section of the IJC and the Public Liaison for the ISRSB, reported that the IJC is performing a complete redevelopment of their website. The IJC started this process in October and were aiming to launch in July. The entire design of the website changed and boards were asked to provide a board website representative. The representatives were sent a document outlining information for the URL and a board email address.

There was a new procedure for publishing documents to the microsite. It was no longer desirable to publish documents directly to the website, instead it would be done through the IJC's record management system. The new process involved sending an email to a specific address and a response would be received including a URL for uploading the document. The IJC planned on having training about the changes in the following weeks. The specific launch date was not set, but it was planned for some time in July.

### G1.2.8 International Souris River Study Board Update

The Canadian Alternate Co-Chair for the ISRSB provided an overview of the main areas that the ISRSB were working on and an update on their recent activities. An action was given for the Co-Secretaries to distribute copies of the ISRSB's Update Presentation to the Board. The Co-chairs discussed in detail various pieces of the work plan.

USACE reported that the draft of revised Annex A of the 1989 International Agreement was submitted to the Board with a deadline of February 14, 2018. No comments were received and the group working on the draft was waiting on the Board's decision to accept the report and formally submit it to the IJC. The Board was not aware of the report's submission and an action was given for the group to resubmit the draft of the revised Annex A of the 1989 International Agreement to the Board for review and comments with a deadline of July 31, 2018.

### G1.2.9 Update on Water Management Projects

#### *G1.2.9a Update on Northwest Area Water Supply Project (NAWS)*

Nicole Armstrong announced that the Bureau of Reclamation (BOR), Department of Interior, and Manitoba reached a settlement regarding NAWS. The settlement was expected to end the litigation surrounding the project. Manitoba first challenged the legality of the project in 2002 based on their belief that the BOR had not followed the National Environmental Policy Act (NEPA) that required them to make an in-depth investigation of the risks on consequences of the project prior to choosing a preferred alternative. During the 16 years of ongoing litigation, the BOR pursued those comprehensive environmental assessments and investigations of the potential risks and consequences. Manitoba's specific main concern was the potential for inter-basin transfer of invasive species, which was assessed and addressed in detail by the BOR leading to the Court's ruling that the BOR had fulfilled their obligations to the NEPA. The Court's ruling then in turn lifted the injunction that had been on the project since 2002.

Manitoba and Missouri appealed the decision. Manitoba's main interest for the appeal was to be included in the ongoing progression of the project. The BOR agreed to set up an Adaptive Management Team that would be involved in the construction of the Biota Water Treatment Plant that would treat the Missouri River Basin water prior to it entering the Hudson Bay Basin. The level of water treatment that Manitoba requested and received was that of potable water. The Adaptive Management Team would also have a role in the development of emergency response measures, treatment monitoring, disruption contingency plans, and ongoing operation procedures.

The implications and outcomes of Missouri's appeal was unknown.
Garland Erbele mentioned that an interesting outcome from the determination of the inter-basin transfer of water under the Boundary Water Treaty's jurisdiction was that the ownership and operation of the treatment plant was determined to remain with the Bureau of Reclamation.

The Bureau of Reclamation was not funded for the construction of a water treatment plant, so the State of North Dakota will fund the construction and be later reimbursed upon transferring ownership to the BOR. The contract for the design of the Biota Water Treatment Plant was issued. The NDSWC also provided funding to the City of Minot for the construction of their water treatment plant (for water softening).

**G1.2.9b Update on Canadian Dam Safety Work**

Since the 2011 event, WSA has been performing considerable investigations into dam safety management at Rafferty and Grant Devine Dams, among other structures that were affected by the flood. The dam safety management, or risk management, of the Canadian Dams were predicated by the Canadian Dam Association Guidelines (CDA), which are based on three principles:

- Risks should be kept as low as reasonably practicable
- The standard of care to be exercised should be commiserate with the consequences of dam failure
- Due diligence should be exercised at all phases of establishing a dam (planning, design, construction, operation, etc.)

It was stated that the CDA guidelines are not law, but the industry best practices that provide a framework for managing risk and are legally defendable.

An overview of various types of dam failure that included embankment failure and different scenarios of overtopping was presented to the Board. The overview also included the topics of the "Sunny Day Failure" and the "Flood Induced Failure," to illustrate the level of warning available prior to a catastrophic failure.

Related to the "Flood Induced Failure" is the Inflow Design Flood (IDF), which is the largest flood that a dam should be designed to handle. WSA described that dams used to be designed for the Probable Maximum Flood (PMF), which was considered to be the greatest volume of flooding that could possibly happen. The thinking shifted to the IDF that takes into consideration incremental volumes of water under varying conditions of already contained volumes of water to determine the fulcrum of conditions where the catastrophic failure of the dam would not significantly impact downstream conditions already experiencing the stress of flooding.

WSA contracted Hatch Engineering to study the IDF for Rafferty and Grant Devine Dams in 2016, and processed the results in order to make determinations. WSA accepted Hatch Engineering's derived results in early winter 2018 as an engineering/operating decision. The report from Hatch Engineering is available.

It was determined that the embankment at Rafferty meets the CDA allowable Factor of Safety and is able to handle the increased loading of the new IDF very well. Rafferty was also able to manage the original IDF of 800 cms (28,248 cfs) with no issues. The additional 33 cms (1,166 cfs) for the new IDF should not pose this type of a problem and when further investigation into the cause of the issue was performed, it was found that the original IDF timing began in the spring when the dam was already drawn down. The new IDF timing begins in June when the operating level of the dam is not at its optimal level for flood issues, and the seasonal timing shows potential for the greatest PMF. In other words, the seasonal shift in dam operations would most likely result in not having the necessary flood storage mitigation available, or the system was not designed to handle late spring/early summer rain events of consequence.

It was discussed that decisions must be made on how to safely accommodate spring/early summer rain events that is agreeable for everyone.

Concerning Grant Devine Dam, there were questions regarding embankment stability that arose from registered movement to the left of the spillway during the 2011 flood. Initial investigations performed during the 2011 flood suggested a Factor of Safety level of 1.0. More in-depth investigations, including a three-dimensional study, were performed after the flood that resulted in an actual factor of safety level of 2.0, well above the industry standard, increasing the confidence in the structural integrity of the dam.

At one time there were concerns that arose from the initial studies done in 2011 and Factor of Safety of 1.3 that brought forth the determination that while Grant Devine Dam withstood the volume of water during that flood, it was recommended that the dam not maintain that volume of water again for any extended period of time. The later, more in-depth study alleviated concerns, and it was determined that Grant Devine Dam performed as expected and would be able to continue to perform as necessary for any extended amount of time.
The original PMF for Grant Devine Dam was 1,200 cms (43,372 cfs). The revised PMF, resulting from the Hatch Engineering study, was reduced to 862 cms (30,437 cfs). The spillway capacity of Grant Devine Dam is 1,300 cms (45,903 cfs), so there are no issues in passing the IDF.

The issue that occurs with Grant Devine Dam is the downstream railroad bridge that causes a choke point for flow. When passing the IDF through the Grant Devine spillway, the railroad bridge embankment and culvert act as a secondary dam that backs water up to the Grant Devine spillway. When the backed-up water reaches a certain level on the spillway, the buoyancy force has the potential to pop the concrete plates of the spillway out of place.
The two possible solutions for this issue are either unrestricting the flow downstream at the railroad bridge, or structural re-enforcement of the spillway to prevent the loss of the concrete caps. WSA was investigating the most cost-effective solution for the issue at Grant Devine Dam.

WSA also indicated that feedback received from the United States concerning these issues would be important for Canada's decision making. The Board decided that a place be reserved on future agendas for an update on Canadian dam safety work.

### G1.2.10 Board Communication

It was reported that the draft Terms of Reference (TOR) for the Communications and Outreach Committee (COC) were prepared in November of 2017 and circulated to a small group of people for comments. The update on the TOR was then placed on the agenda for the Board February 2018 meeting in Minot, ND, but inclement weather prevented the attendance of key Board members.

A draft version of the TOR outlined the following COC role and responsibilities:

- Increase awareness of the Board's role and responsibilities in the Souris Basin
- Conduct reviews and propose updates to Board's content on the IJC webpage
- Prepare and maintain general public information and plain language fact sheets related to the technical findings of Board studies and emerging issues in the Basin
- Alert the Board to potential concerns related to the mandate of the Board requiring improved communications and outreach
- Assist and advise the Board and its committees on necessary improvements in communicating activities as well as science and technical information to the public, including improvements to the Annual Report
- Organize the Annual Public Meeting of the Board, as well as specific meetings with greater watershed groups and local governments to improve the Board's communications
- Undertake additional communications and outreach activities as directed by the Board

The committee intends to report to the Board through the Co-chairs. A record of decisions would be produced for all activities of the COC and be provided to the Board as a means of on-going reporting.

Membership to the COC would be approved by the Board, but not limited to agencies associated with the Board. The Board would review the membership of the COC as required. Co-chairs, one from the United States and one from Canada, would be selected by the members of the COC and serve for a two-year term. Associated costs for each committee member would be borne by the corresponding agency of the member.

Meetings would be on an 'as required' basis, determined by communication with the ISRB and input from Committee members. The COC would exist as an on-going committee until the TOR's were either modified or replaced by the Board.

The Board amended the role and responsibility to include Indigenous People in the listed groups for which awareness is to be increased. After the amendment, the TOR for the COC was accepted by the Board.

### G1.2.11 International Souris River Board Work Plan

A new and updated version of the last workplan from 2011 was introduced during the meeting. Some of the workplan topics at that time were no longer relevant with the advent of the ISRSB and their investigation. It was mentioned that the new workplan was built around the 2007

directives and included key items such as overseeing implementation of compliance of the apportionment measures, the oversight function for flood operations, the joint water quality monitoring program and AEHC, providing public involvement opportunities, and maintaining awareness of proposed and existing developments.

It was requested that each committee review the draft copy of the TOR for the items that their committee is responsible for and update those items reflect their current progress. Once finished, the committees were requested to submit their comments and changes to the Board so that they all may be compiled into a final copy to be distributed to the Board for review. The Board agreed and an action was given to have committees review the work plan and provide comments to the Board prior to the Semi-Annual meeting in October.

# APPENDIX H

# Work Plan

# International Souris River Board
# Work Plan 2019

## Result 1: Oversee the implementation of compliance with the 2000 Interim Measures for Apportionment of the Souris River as modified

| Goals | Lead | Activities |
|---|---|---|
| Compliance with the Interim Measures as Modified. | Canadian and US monitoring agencies<br><br>Board Members | Monitor and approve apportionment for the Souris River basin in accordance with 2000 Interim Measures as Modified. |
| | Hydrology Committee | Develop a simple procedures manual for the computation of natural flows and the determination of apportionment.<br><br>Develop a supplemental document containing the details and history of the Hydrology Committee and the development of the apportionment determinations. |

## Result 2: Perform an oversight function for flood operation

| Goals | Lead | Activities |
|---|---|---|
| Effective and cooperative flow forecasting and flood operations. | Flow Forecasting Liaison Committee | Facilitate information sharing for flow forecasting and approve official forecasted runoff in the Souris River basin for flood/non-flood decision.<br><br>Maintain a watch on low flow conditions during 2019. |

**Result 3: Assist the Commission with the Joint Water Quality Monitoring Program and report on aquatic ecosystem health issues in the watershed**

| Goals | Lead | Activities |
|---|---|---|
| Oversee a Joint Water Quality Monitoring Program | Aquatic Ecosystem Health Committee | Complete a review of the joint water quality monitoring program with a focus on reporting and recommend adjustments to the program (ongoing). |
| Identify aquatic ecosystem health issues in the watershed | Aquatic Ecosystem Health Committee | Implement an IWI project for an investigation of dissolved oxygen concentrations in the Souris River including the placement of continuous dissolved oxygen/temperature sensors at Sherwood.<br><br>Identify ecosystem health related information to add to the annual report (for example, aquatic nuisance species).<br><br>Develop a proposal for reviewing and updating water quality objectives at the Saskatchewan/North Dakota and North Dakota/Manitoba borders starting with an assessment of trends in water quality. |

**Result 4: Provide opportunities for the public to be involved in the work of the board**

| Goals | Lead | Activities |
|---|---|---|
| Increase awareness of the Board, its role, and communicate issues and successes with the public. | Canadian and US Co-secretaries, Canadian and US Chairs | Host one annual public meeting in the basin to present an overview of the Board's role and activities and to consult with the public and stakeholders in the basin.<br><br>Attend and report on Board activities to IJC at its semi-annual meetings in April and October, as required.<br><br>Communicate on-going apportionment and critical conditions to the IJC and the public, as required. |
| | Communications and Outreach Committee | Develop a communication strategy for the ISRB.<br><br>Prepare plain language fact sheets and infographics to promote and increase awareness of the role and responsibilities of the Board.<br><br>Support the Board with organizing the 2019 annual public meeting.<br><br>Review and update of the Board's information hosted on the IJC's web on a regular frequency (once every two months). |

**Result 5: Maintain an awareness of existing and proposed developments, and carry out other studies or activities the Commission may request**

| Goals | Lead | Activities |
|---|---|---|
| Prevent and resolve transboundary concerns in the basin | Board Members | Report on existing and proposed developments, conditions, activities, and issues in the basin at the board's semi-annual meetings. |
| | Canadian and US Co-chairs and co-secretaries<br><br>Board Members (especially those co-appointed to the International Souris River Study Board) | Share information regarding the implementation of the Plan of Study with the ISRB board members and facilitate collaboration between the two boards |
| Effective and cooperative management of the Board functions | Canadian and US co-secretaries | Prepare meeting Minutes within three weeks of the meeting.<br><br>Prepare an annual report for 2018 by October 2019 |